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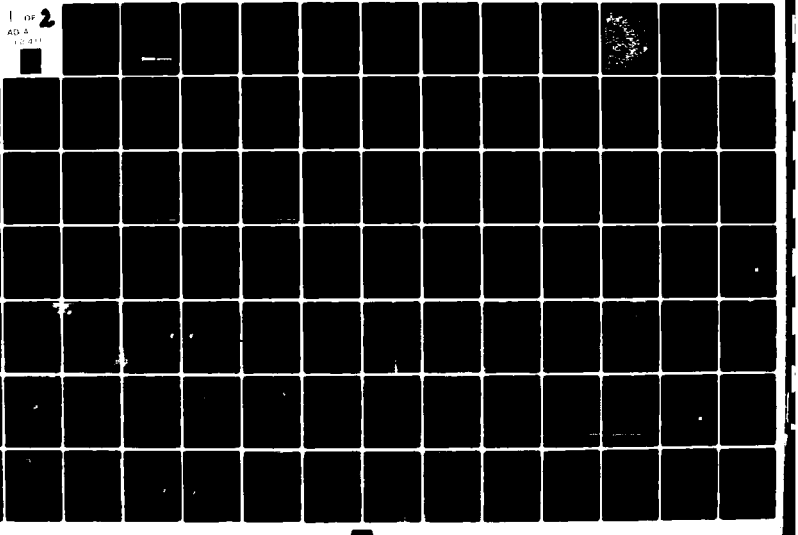

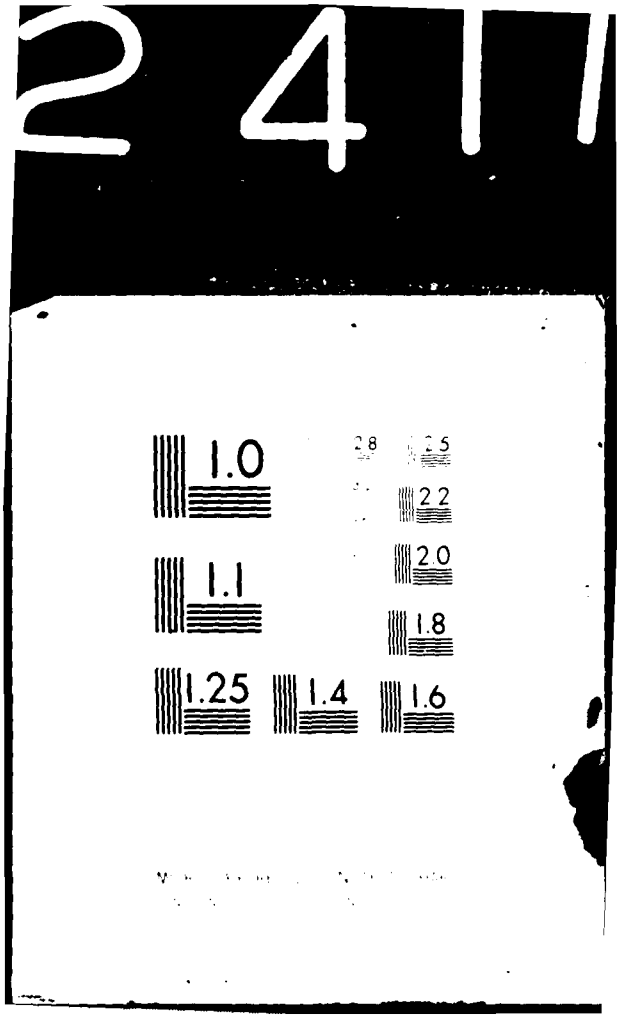
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PROPOSED OPERATIONAL BASE SITE

ESCALANTE DESERT,

MILFORD AREA, UTAH

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

Fugro National, Inc.
3777 Long Beach Boulevard
Long Beach, California 90807

10 March 1980

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The potential operational base site in the Escalante Desert, Milford area, Utah, was evaluated to determine its geographic, cultural, geotechnical, and geohydrologic conditions. This study was limited to evaluating the relative suitability of this area as a potential operational base using subjective geotechnical criteria.

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1.0 INTRODUCTION

In November 1979, Fugro National, Inc. was tasked to carry out studies supporting the selection of an operational base location or locations. The studies are to include information about water supply, land ownership, existing and proposed transportation systems, terrain, and geotechnical conditions. Using this information, conceptual layouts are to be prepared showing the operational base, designated assembly area, missile assembly buildings, and operational base test site.

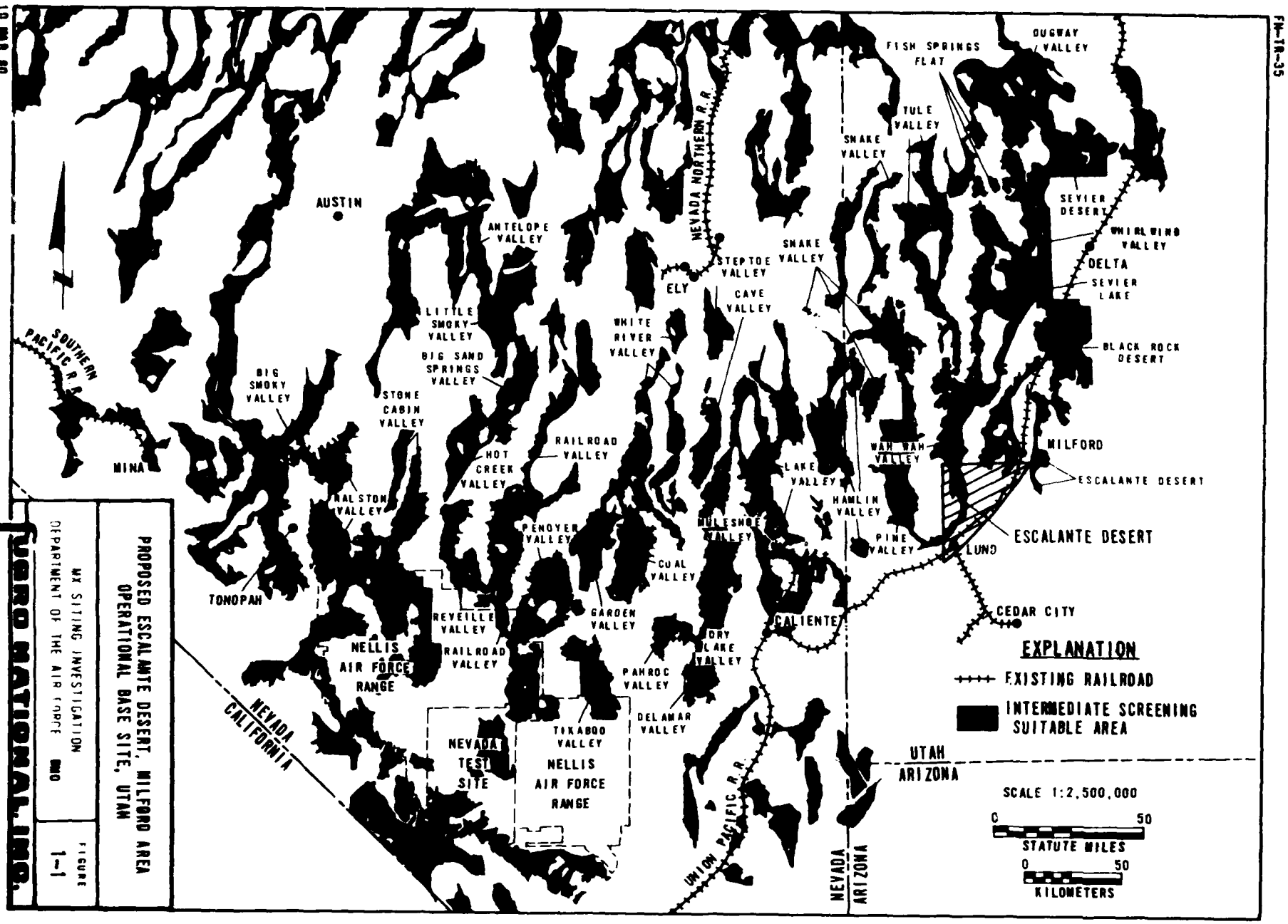
The original work statement specified that the following areas should be studied:

- Pahroc/Pahranagat Valley region;
- Ely region;
- Delta region; and
- Mina region.

Since the preparation of the original work statement, there have been a number of meetings and discussions concerning the location of the operational base. It was recognized that extensive study would be required before a final selection could be made. It was decided, therefore, that it would be beneficial if Fugro National, Inc. could provide as much information as possible about a number of sites, and do so as quickly as possible. As a result of this decision, a preliminary report titled "Initial Operating Base Report" was submitted on 21 December 1979. Eleven possible sites were identified in that report and various conceptual layout options were presented.

In January 1980, Fugro National, Inc. received information from the BMO which stated that Strategic Air Command's (SAC) preference for an operational base was the Coyote Spring and Kane Springs area in Nevada. Based on this information, Fugro National, Inc. began by concentrating its studies on this area. An interim report on Coyote Spring and Kane Springs valleys was submitted on 27 February 1980 under the report designation FN-TR-35.

This second interim report contains data for the operational base site proposed for the Escalante Desert, Milford area, Utah (Figure 1-1). It is planned to prepare a third report on the Steptoe Valley, Ely area, Nevada in the latter part of March.



PROPOSED ESCALANTE DESERT, MILFORD AREA OPERATIONAL BASE SITE, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

FIGURE 1-1

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FM-TR-35

2.0 SCOPE

The potential operational base site in the Escalante Desert, Milford area, Utah, was evaluated to determine its geographic, cultural, geotechnical, and geohydrologic conditions. The geographic and cultural conditions were compiled from Bureau of Land Management master title plats and available topographic maps which were either U.S. Geological Survey 7.5- or 15-minute sheets. The geotechnical and geohydrological conditions were evaluated by a review of geologic and hydrologic literature and maps and by interpretation of aerial photographs (1:25,000 scale). A ground reconnaissance of the potential operational base area has not been made.

This study was limited to evaluating the relative suitability of this area as a potential operational base using subjective geotechnical criteria. This study was conducted without benefit of large-scale topographic maps and does not attempt to determine specific road or railroad alignments, structure location or design, and construction cost estimates. Proposed options for operational base layouts are based on best estimates of the actual conditions on site. The airfield orientation was selected without the benefit of actual on-site wind direction data.

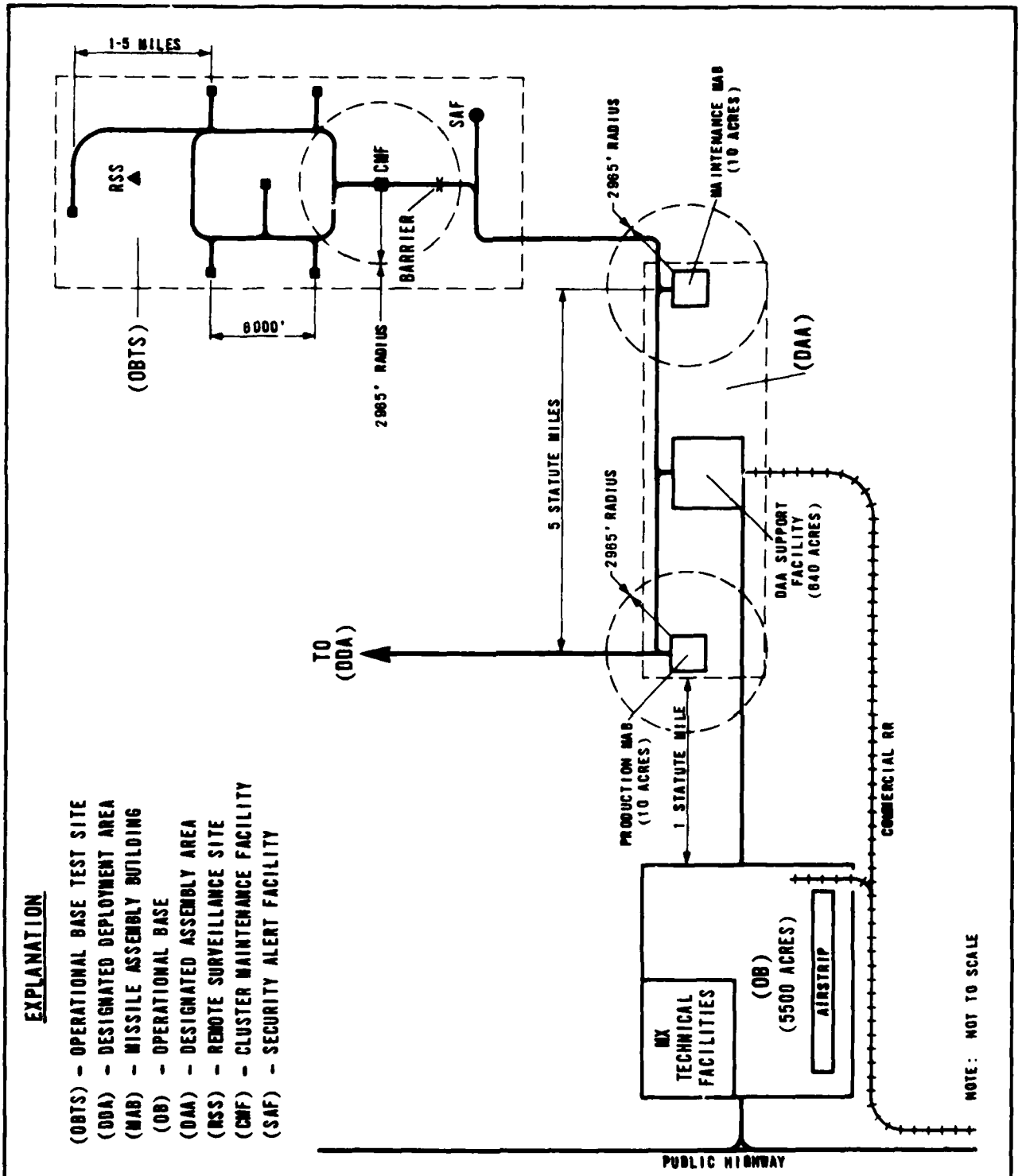
3.0 OPERATIONAL BASE - GENERAL DESCRIPTION AND LAYOUT CRITERIA

3.1 OPERATIONAL BASE STRUCTURES

Conceptually, the operational base consists of three main activity centers; 1) the operational base proper, 2) the designated assembly area, and 3) the operational base test site (Figure 3-1). Each of these centers has an estimated size and, in some cases, a specified distance from other centers or structures.

The Operational Base (OB) consists of technical facilities supporting the MX System, housing, attendant support facilities, and a 10,000-foot runway. The area needed for these facilities is estimated to be about 5500 acres or 8.6 mi^2.

The Designated Assembly Area (DAA) consists of the production Missile Assembly Building (MAB), the maintenance Missile Assembly Building (MAB), and the DAA support facility. The DAA support facility is estimated to occupy 640 acres or 1 mi^2. It will contain a munitions facility, missile stage storage area, special transport vehicle assembly area, cannister storage, security, and contractor support area. The maintenance MAB and the production MAB each would be approximately 10 acres in area. They would both be situated at least 2965 feet from the nearest structure. The two MABs must be a minimum of 5 statute miles apart, while the DAA as a whole should be no less than 1 statute mile from the OB.



CONCEPTUAL OPERATIONAL BASE LAYOUT

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FIGURE
3-1

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The Operational Base Test Site (OBTS) will consist of a Security Alert Facility (SAF) and a test cluster area. The test cluster area will have 1) a road barrier, 2) a Cluster Maintenance Facility, or CMF (situated at least 2965 feet from the nearest structure), 3) five shelters spaced 3000 to 7000 feet apart, 4) a dash track 1 to 5 miles long with a shelter at the end, and 5) a Remote Surveillance Site (RSS).

3.2 OPERATIONAL BASE AIRFIELD

The primary concerns in selecting an airfield site are the wind direction, the amount of unobstructed air space, and the flying conditions in the area.

The main runway should be oriented parallel to the predominant wind direction. Minor deviations in orientation are possible if there are problems because of terrain conditions or populated areas on the extended runway centerline. A crosswind runway should not be considered unless wind coverage on the primary runway is less than 90 percent, or when the beam wind component on the primary runway is 13 miles per hour during periods of restricted visibility. An extended meteorological study would be needed to determine these factors.

Airspace around an airfield should be free of obstructions to maintain a high level of safety. Criteria for ensuring unobstructed airspace have been developed by the Air Force (AFM 86-8) and the Federal Aviation Administration (FAR Vol XI), as shown in Figure 3-2 and discussed in the following paragraphs.

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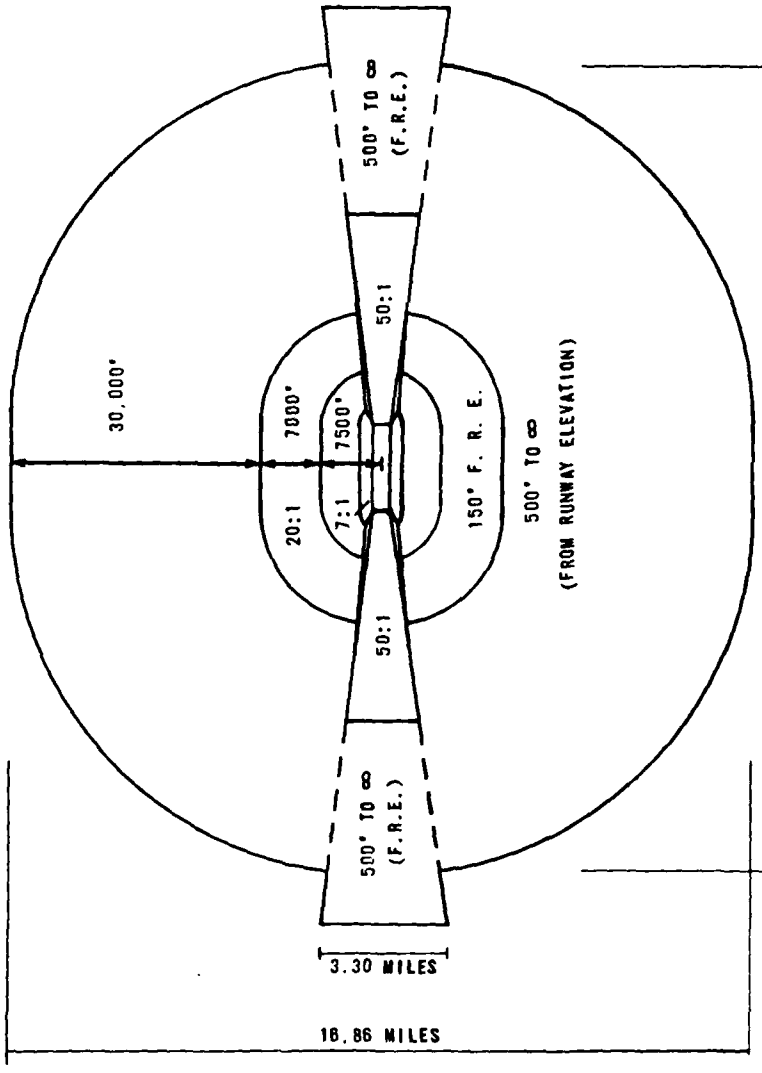
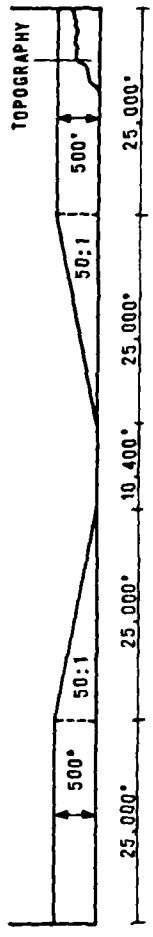
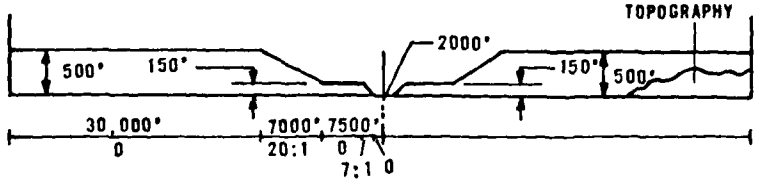


PLAN

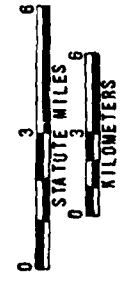


ELEVATION PARALLEL TO RUNWAY



ELEVATION AT RIGHT ANGLES TO RUNWAY

APPROXIMATE SCALE
1:250,000



VERTICAL EXAGGERATION: 10 X

UNOBSTRUCTED AIRSPACE
10,000' PRIMARY INSTRUMENT RUNWAY

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FIGURE
3-2

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For both approach and departure, the unobstructed airspace begins 200 feet from the end of the paved runway. It rises at a slope of 50:1 for a horizontal distance of 25,000 feet, at which point it is 500 feet above the runway. This unobstructed airspace continues at 500 feet above the runway for another 25,000 feet. At the same time, the approach/departure corridor widens to 16,000 feet at the ends. The total length of the approach and departure airspace is 20.9 miles.

The airspace on either side of the runway should also be unobstructed. Beginning at the edge of the runway, the unobstructed airspace rises at a slope of 7:1 for a horizontal distance of 1050 feet at which point it is 150 feet above the runway. This elevation is maintained for another 5450 feet outward from the runway. At this point the slope again rises at a ratio of 20:1 so that over the next 7000 feet, an elevation of 500 feet above the runway surface is reached. This 500-foot elevation is maintained for an additional 30,000 feet outward from the runway. This condition must exist completely around the runway except where the approach/departure airspace takes precedence. No object (topographic or manmade) within 44,500 feet of the runway should be higher than 500 feet. The total width of the regional unobstructed airspace is approximately 17 miles.

The existing flying conditions in an area should also be evaluated. The impact on flight [illegible]idors, other airfields, and areas of military operation o[illegible]tricted use should be determined.

The Federal Aviation Administration (FAA) is the responsible federal agency on this subject. All permit applications and follow-on studies (i.e., weather, wind, flight patterns, etc.) must go through the FAA, which in turn releases the results of this review as recommendations. The jurisdiction for permitting, airfield construction, and maintaining unobstructed airspace lies with the local government for each community.

3.3 TRANSPORTATION REQUIREMENTS

An operational base site must have the ability to be connected to a major highway and a major railroad while still being accessible through the Designated Transportation Network (DTN) to the Designated Deployment Area (DDA). The highway and a rail spur will connect the OB with the DAA. Transportation from the DAA to the DDA and the OBTS will be along the DTN.

4.0 GEOGRAPHIC AND CULTURAL CONDITIONS

4.1 LOCATION

Escalante Desert is an irregular valley, generally trending northeast-southwest. It is approximately 88 miles long and 32 miles wide at the widest point. The valley is located in southwestern Utah (Figure 1-1). The northern half of the valley is in Beaver County and the southern half in Iron County. The largest communities within the valley are Milford, Minersville, and Cedar City. Milford and Minersville are located in the northern portion of the valley and have populations of 1350 and 500, respectively (Beaver County Clerk, 1980).

In the southern portion of the valley, the largest town is Cedar City. Its population is estimated to be between 13,000 and 15,000 (Iron County Clerk, 1980). Milford and Cedar City are 48 miles apart.

The main highways in the valley are State Highways 21, 130, 19, and 56. State Highway 21 runs east-west through Milford and Minersville. State Highway 130 is a north-south route connecting Minersville to Cedar City, a distance of 35 miles. State Highway 56 traverses the southern portion of Escalante Desert east-west from Cedar City to Panaca, Nevada. State Highway 19 trends northwest from Cedar City to Lund, a distance of 33 miles. One other paved road runs north from Highway 56 to Beryl. Both Lund and Beryl are located along the Union Pacific Railroad, which runs the length of Escalante Desert on the northwestern side. Both towns have populations less than 50.

Interstate 15 does not cross the Escalante Desert, but it parallels the southeastern edge and is the main route from Cedar City to Las Vegas.

The Milford study area occupies only a small portion of the total Escalante Desert. The study area is in the central portion of the valley, northwest of the Union Pacific Railroad. The area boundary along the railroad extends from Milford on the north to Lund on the south. The study area is bounded on the west by the Wah Wah Mountains and on the north by the Shauntie Hills-Star Range. The area also includes the southern portion of Wah Wah Wash.

4.2 LAND STATUS

The study area, like the rest of Escalante Desert, consists generally of state and private property. The chief land use in the area is ranching. Less than half of the area consists of public lands administered by the Bureau of Land Management (BLM) from their Cedar City District Office. Much of the public land may contain grazing rights. Within the limited BLM lands, there exist two applications for withdrawal which would change the present land status. The first is a state exchange application for 5290 acres (8.3 mi^2) along Wah Wah Wash and westward to the Wah Wah Mountains. This land, once acquired by the State of Utah, would be sold or leased to the Alumet Company for the purpose of developing a large alunite mining operation. The operation, as presented in the Environmental Impact Report (Bureau of Land Management, 1977), could represent a conflict of

interest with either an operational base in the Milford area or with any possible cluster placement in southern Wah Wah Valley. The mining plan calls for a 20-mile rail spur, a 75-megawatt power plant, a processing plant, and a water-well system. The estimated annual water usage for the Alumet operation within the Milford area would only be 32 acre-feet. The land exchange procedure between the BLM and the State of Utah is a very standard practice. It is not known when the Alumet Company might begin such an operation.

The second activity which could cause a potential change in land status is a request for a Color of Title. In this case, 180 acres (0.25 mi^2) of land southwest of Milford and northwest of the railroad was thought to be private property but, in fact, could possibly be BLM land. The individual who has paid taxes and made improvements on this land must file an application for Color of Title. In this title request, he must prove that the BLM actually released the property for private use.

Within the Escalante Desert and the study area proper, there exist several Known Geothermal Resource Areas (KGRA). Approximately 7680 acres (12 mi^2) of KGRA are within the operational base study area (Utah Geologic and Mineral Survey, 1977). The majority of the valley and most of the study area have potentially valuable geothermal resources.

5.0 GEOTECHNICAL CONDITIONS

5.1 TERRAIN

Escalante Desert is a generally flat, linear valley bounded on the northwest and southeast by gently sloping (less than 3°) alluvial fans (Drawing 5-1). The fans are larger and more extensively incised along the northwestern valley margin than along the southeastern margin. Incised stream channels on both the northwestern and southeastern fans are generally less than 3 feet deep, except south and east of the Shauntie Hills where the terrain has been excluded from MX shelter deployment based on the incision depth and drainage spacing criterion. Excluded terrain is also present northwest of the Star Range along the banks of Big Wash because of deep incisions. Shallow rock is also present within this terrain exclusion area.

Hummocky terrain occurs in the axial portion of Escalante Valley due to the presence of sand dunes. Sand dunes within the study area occur mainly southwest of Blue Knoll.

5.2 FAULTING

Most of the study area is located within the Intermountain Seismic Belt delineated by Smith and Sbar (1974). It is a zone of seismicity that trends generally northward through western Utah. The seismic belt has been the locus of frequent small to moderate magnitude earthquakes in historic times, but geologic data suggest that much larger events are probable (Cook, 1971).

A Quaternary fault map of Utah (Anderson and Miller, 1979) shows several northeasterly trending faults in the study area which are known or suspected to have had Quaternary (within the last 2 to 3 million years) movement. Several of these faults are expressed as scarps on aerial photos. Numerous north-south trending Quaternary faults are located immediately east, northeast, and southeast of the study area. Quaternary or suspected Quaternary faults that exist within the study area are shown on the enclosed terrain and fault conditions map (Drawing 5-1). In addition, several possible faults and fault-related features have been interpreted from aerial photos as occurring in basin-fill within the study area. Faults exist within the mountain blocks also (bedrock faults), but have not been shown on the enclosed map.

5.3 FLOODING POTENTIAL

Major flash flooding within the study area would probably be confined to floodplains of the larger washes such as 1) Mud Spring Wash, located adjacent to the southwestern margin of Black Mountains; 2) Big Wash, located immediately north of the Black Mountains; and 3) Big Wash, located between Star Range and Beaver Lake Mountains. Flash flooding may also occur in some of the larger washes flowing southerly from the Shauntie Hills area.

Sheet flooding is likely to occur on the southeasterly draining fans along the front of the Shauntie Hills and Star Range due to general lack of well defined drainages. Sheet flooding may also

occur on the northerly draining fans along the northe.n margin of the Black Mountains.

Temporary ponding of water is likely to occur in low-lying flat areas such as Lund Flats and The Sink.

6.0 GROUND-WATER CONDITIONS

6.1 WATER AVAILABILITY

The main aquifer in the Milford study area is the unconsolidated valley-fill deposits. In some areas, highly fractured carbonate rocks constitute a productive aquifer.

6.1.1 Perennial Yield

Annual water-level data compiled by Mower and Cordova (1974) indicate that water levels declined 0 to 30 feet between 1950 and 1970, with the area of greatest decline centered 7 miles south of Milford. Water-level measurements were made by the U.S. Geological Survey for the period 1935-1955 and 1956-1970. The water-level decline is caused by pumping for irrigation. Based upon the withdrawal and decline rates, Mower and Cordova (1974) estimated the total annual recharge to the valley-fill deposits to be 58,000 acre-feet; it is assumed that this estimate is also the available perennial yield (Table 6-1).

6.1.2 Present Water Use

Total annual ground-water consumption is 65,000 acre-feet (Gates,et al., 1978). Municipal and domestic uses total 1000 acre-feet, and 64,000 acre-feet are used for irrigation. Except for 1973 when only 52,000 acre-feet were pumped, annual ground-water withdrawal has exceeded the perennial yield since 1970.

6.2 WATER QUALITY LIMITATIONS

The quality of the ground water contained in the valley-fill deposits is generally good to fair (Mower and Cordova, 1974),

GROUND WATER AVAILABILITY (IN ACRE FEET PER YEAR)						
PERENNIAL YIELD [1]	PRESENT USE				SOURCE	
58,000	65,000				1) ALLUVIUM: VALLEY FILL AQUIFER 2) FRACTURED CARBONATE ROCKS	
	IRRIGATION	INDUSTRIAL	MUNICIPAL	DOMESTIC STOCK		
	64,000	—	800	200		

[1] PERENNIAL YIELD IS THE AMOUNT OF GROUND WATER THAT CAN BE WITHDRAWN PER YEAR FROM A BASIN WITHOUT CAUSING U

[2] N A = DATA NOT AVAILABLE

FEET PER YEAR)			POTENTIAL IMPACTS			
URCE	QUALITY		GROUND WATER LEVELS	WATER QUALITY	SPRING DISCHARGE	WILDLIFE
EY FILL AQUIFER CARBONATE ROCKS	MODERATE TOTAL DISSOLVED SOLIDS		INCREASED DECLINE LOCALLY	NONE	N.A.[2]	N.A.
	POTABILITY	CONSTRUCTION POTENTIAL				
	GOOD-FAIR	GOOD				

A BASIN WITHOUT CAUSING UNDESIRABLE EFFECTS

SUMMARY TABLE OF GROUND WATER CONDITIONS IN ESCALANTE DESERT, MILFORD AREA, UTAH

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TABLE 6-1

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with total dissolved solids ranging from 224 to 4600 mg/l with a median of 569 mg/l. However, there has been a consistent increase in total dissolved solids since 1950. In areas of intensive irrigation, the total dissolved solids concentration may exceed recommended drinking water standards (2000 mg/l) set by the U.S. Department of Health, Education, and Welfare (1962). But overall, the ground water is suitable for human consumption and construction.

6.3 IMPACT OF WITHDRAWAL

Mower and Cordova (1974) show that current pumpage exceeds the perennial yield, and water levels are declining in the Milford area. Additional ground-water development would increase the rate of water-level decline. It is doubtful if ground-water withdrawals from the operational base would significantly deteriorate ground-water quality. The Utah State Engineer's Office has indicated that no additional ground-water withdrawals would be allowed in the Milford area (Hansen, 19[illegible]. Water for the operational base would have to be purchased from existing water users in order to comply with the state and to avoid detrimental effects on the ground-water system in the valley-fill deposits.

It is possible, however, that the carbonate aquifer could be utilized as a source of water for the operating base if water could not be purchased.

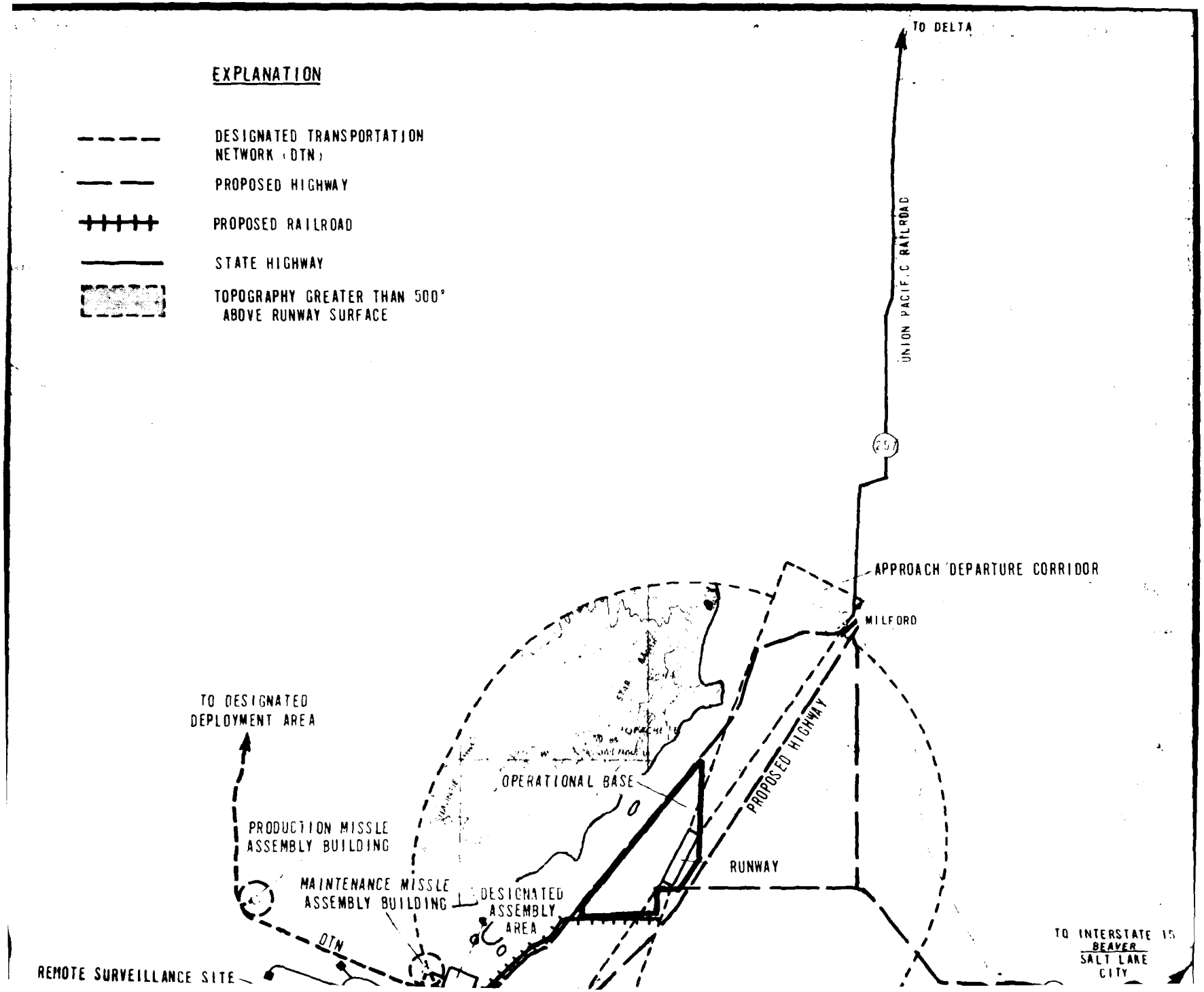
7.0 OPERATIONAL BASE LAYOUT OPTIONS

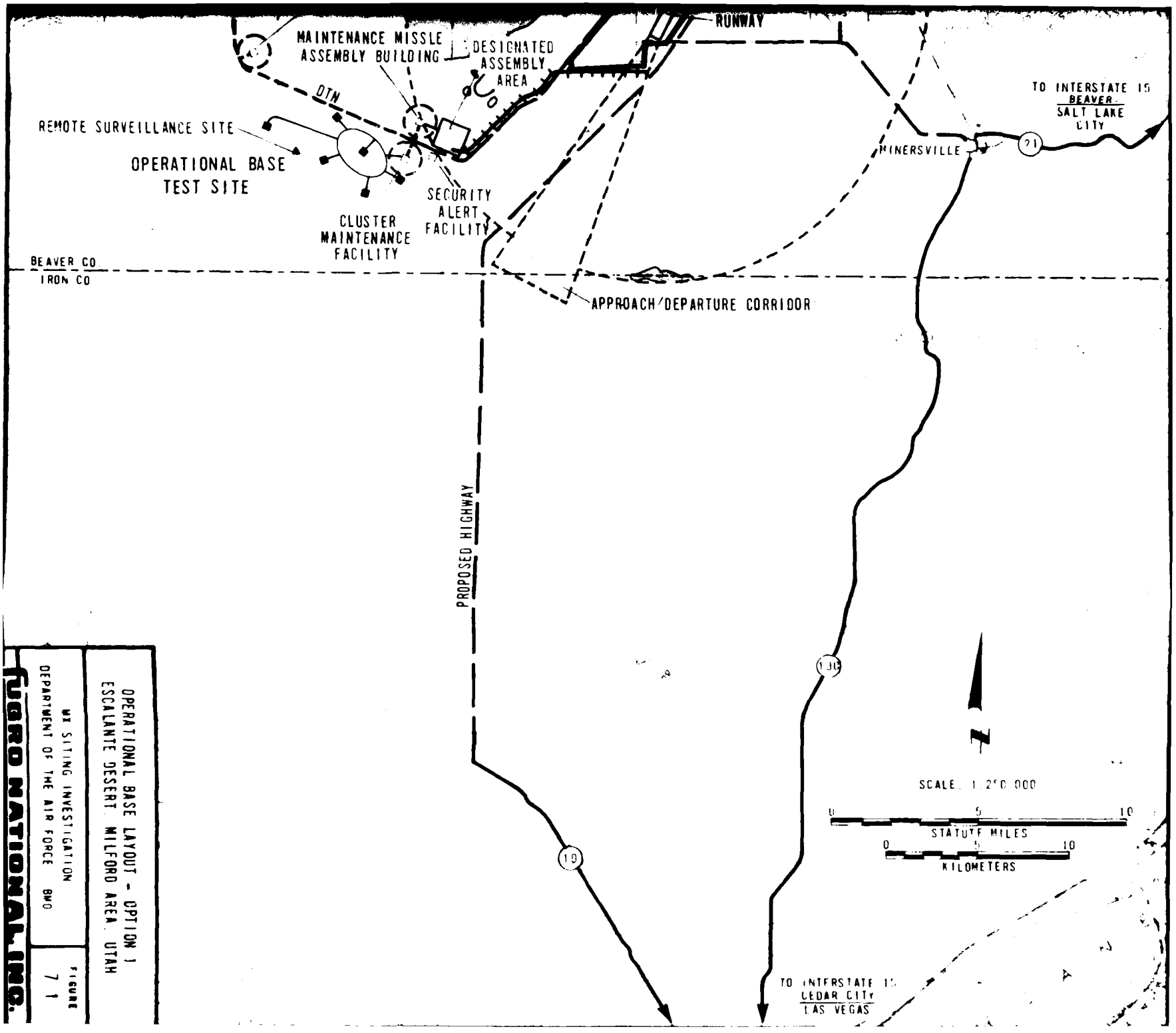
7.1 FACTORS GOVERNING THE OPERATIONAL BASE SITE SELECTION

Four possible operational base configurations were developed in the Milford area. Of these, two configurations utilize the same site in Beaver County for the operational base proper; in the other two configurations, the OB is at two different locations in Iron County. These configurations (Figures 7-1 to 7-4) are based on the data presented in the previous sections of this report. The OB locations are controlled by the availability of 5500-acre area and by the unobstructed approach and departure airspace needed for the airfield. It is preferred that the 5500-acre area be on BLM land.

There is no area 17 miles by 20.9 miles of wholly unobstructed airspace in the study area, but there is a zone paralleling the railroad where the approach/departure criteria can be met. This zone trends northeast/southwest and assumes that the prevailing wind is also northeast/southwest. There is a possibility of crosswinds at the junction of Wah Wah Valley and Escalante Desert.

Within the zone of acceptable airspace use, there are three areas of contiguous BLM land. One area is at the northern end of the study area near Milford in Beaver County and the other two are in Iron County. Of the two in Iron County, one is just south of the county line, and the other is north of Lund. None of these three sites has enough contiguous BLM land (5500 acres) to contain the OB. The site in Beaver County


EXPLANATION
DESIGNATED TRANSPORTATION NETWORK (DTN)
PROPOSED HIGHWAY
PROPOSED RAILROAD
STATE HIGHWAY
TOPOGRAPHY GREATER THAN 500' ABOVE RUNWAY SURFACE
TO DELTA
UNION PACIF.C RAILROAD
257
APPROACH DEPARTURE CORRIDOR
MILFORD
TO DESIGNATED DEPLOYMENT AREA
OPERATIONAL BASE
PROPOSED HIGHWAY
PRODUCTION MISSLE ASSEMBLY BUILDING
MAINTENANCE MISSLE ASSEMBLY BUILDING
DESIGNATED ASSEMBLY AREA
RUNWAY
DTN
REMOTE SURVEILLANCE SITE
TO INTERSTATE 15
BEAVER
SALT LAKE CITY

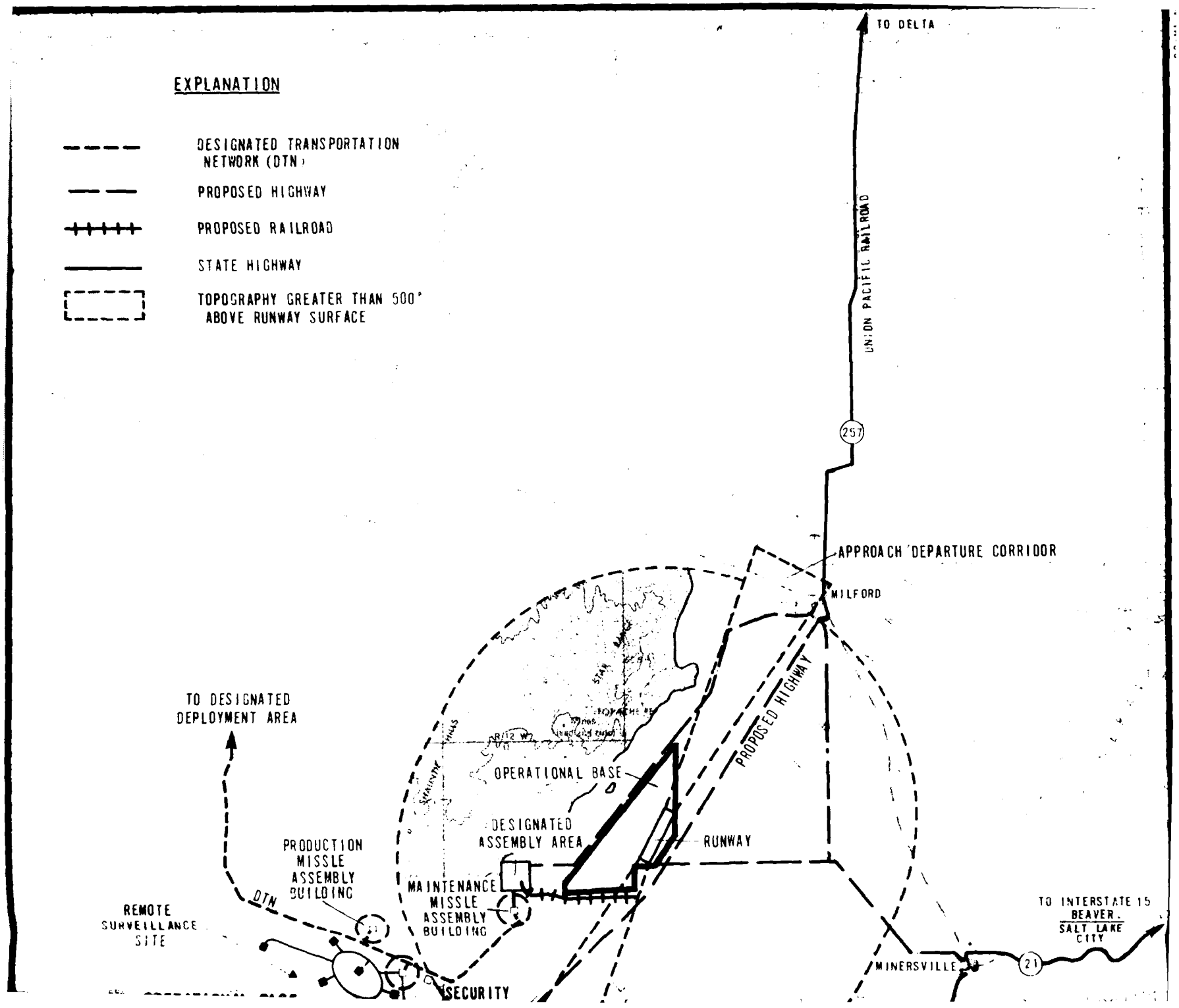


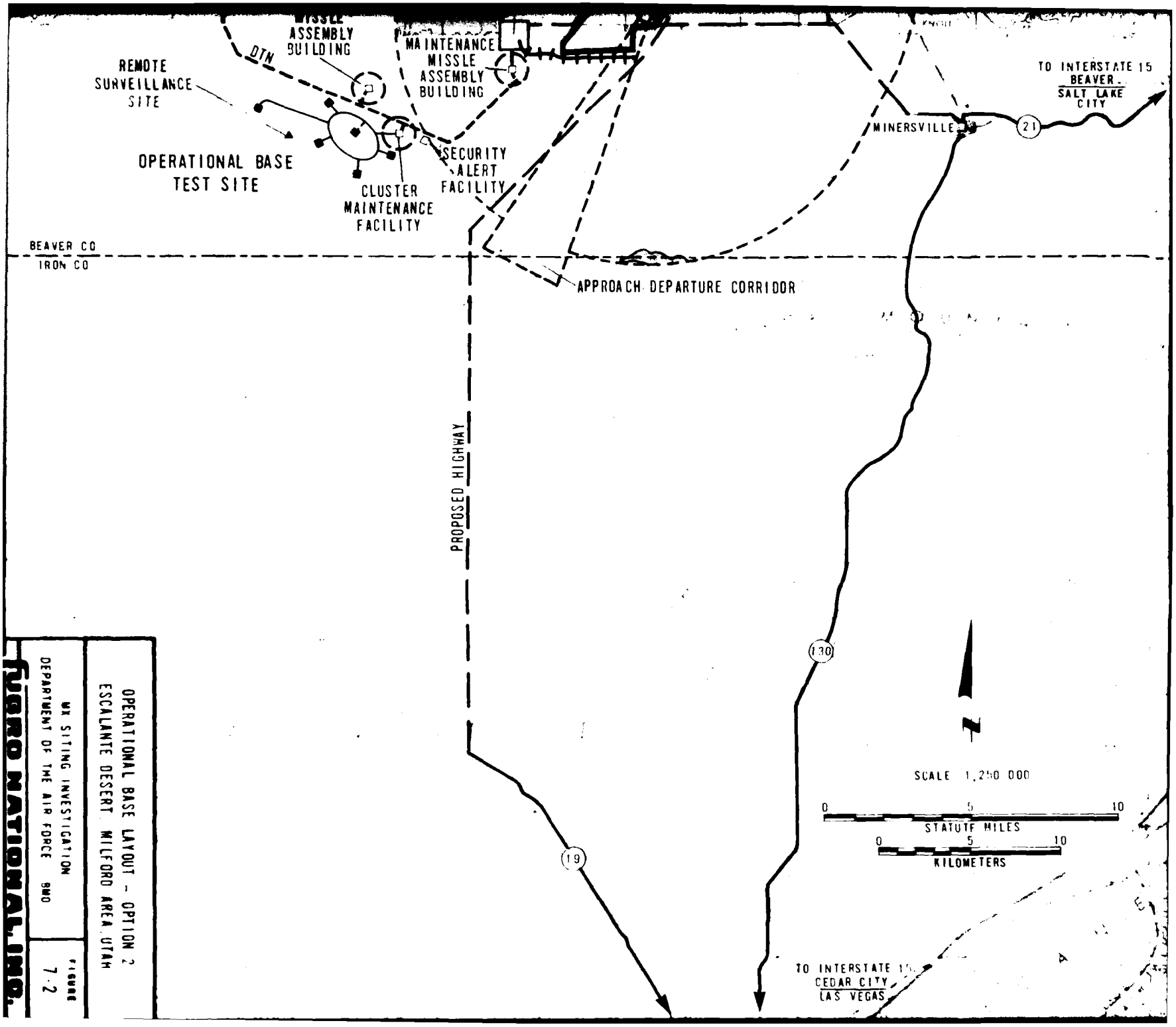
OPERATIONAL BASE LAYOUT - OPTION 1
ESCALANTE DESERT, MILFORD AREA, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE 7.1

FUGRO NATIONAL, INC.


EXPLANATION
DESIGNATED TRANSPORTATION NETWORK (DTN)
PROPOSED HIGHWAY
PROPOSED RAILROAD
STATE HIGHWAY
TOPOGRAPHY GREATER THAN 500' ABOVE RUNWAY SURFACE
TO DELTA
UNION PACIFIC RAILROAD
257
APPROACH DEPARTURE CORRIDOR
MILFORD
PROPOSED HIGHWAY
TO DESIGNATED DEPLOYMENT AREA
OPERATIONAL BASE
DESIGNATED ASSEMBLY AREA
RUNWAY
PRODUCTION MISSLE ASSEMBLY BUILDING
MAINTENANCE MISSLE ASSEMBLY BUILDING
DTN
REMOTE SURVEILLANCE SITE
SECURITY
MINERSVILLE
21
TO INTERSTATE 15
BEAVER.
SALT LAKE CITY

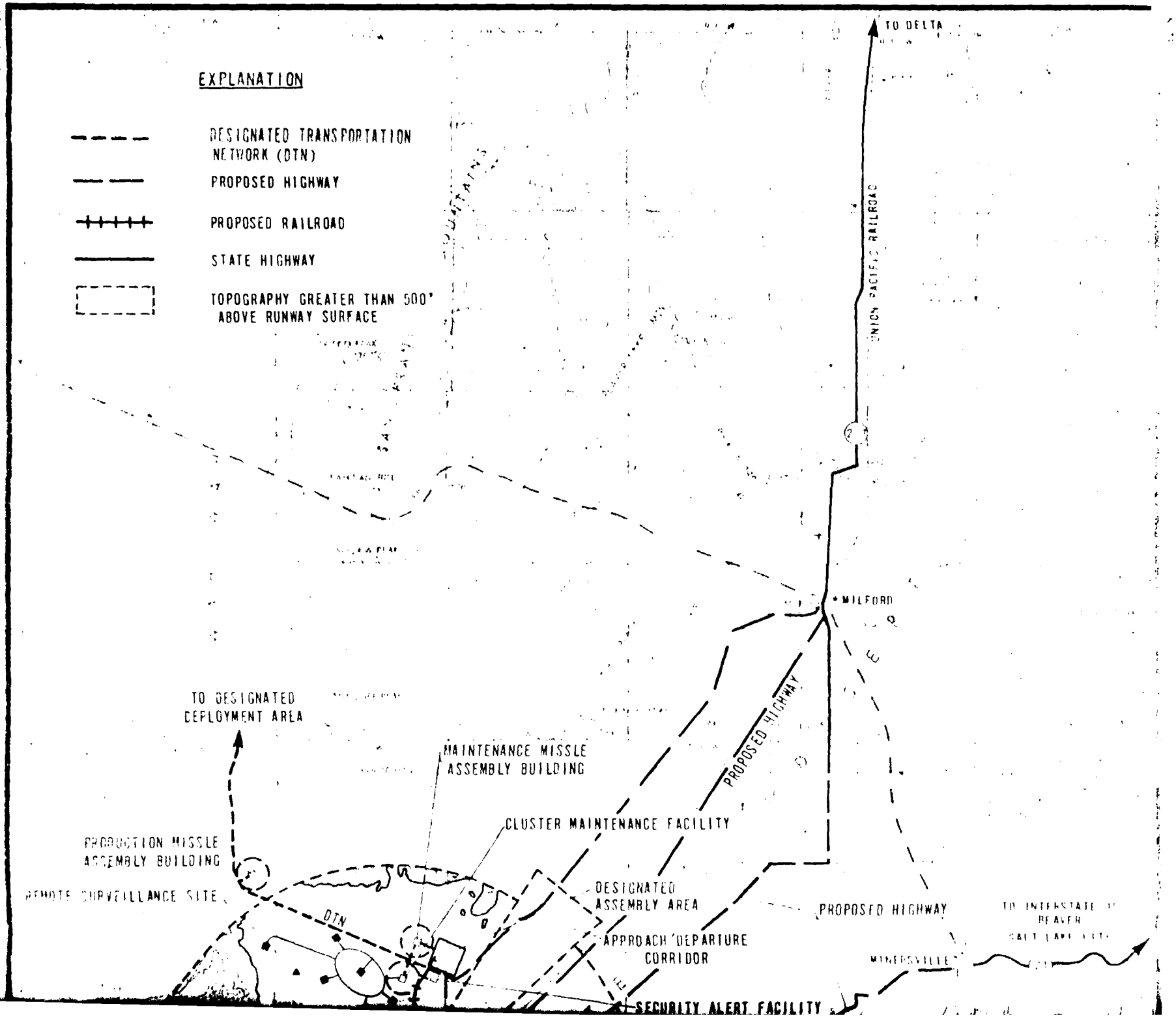


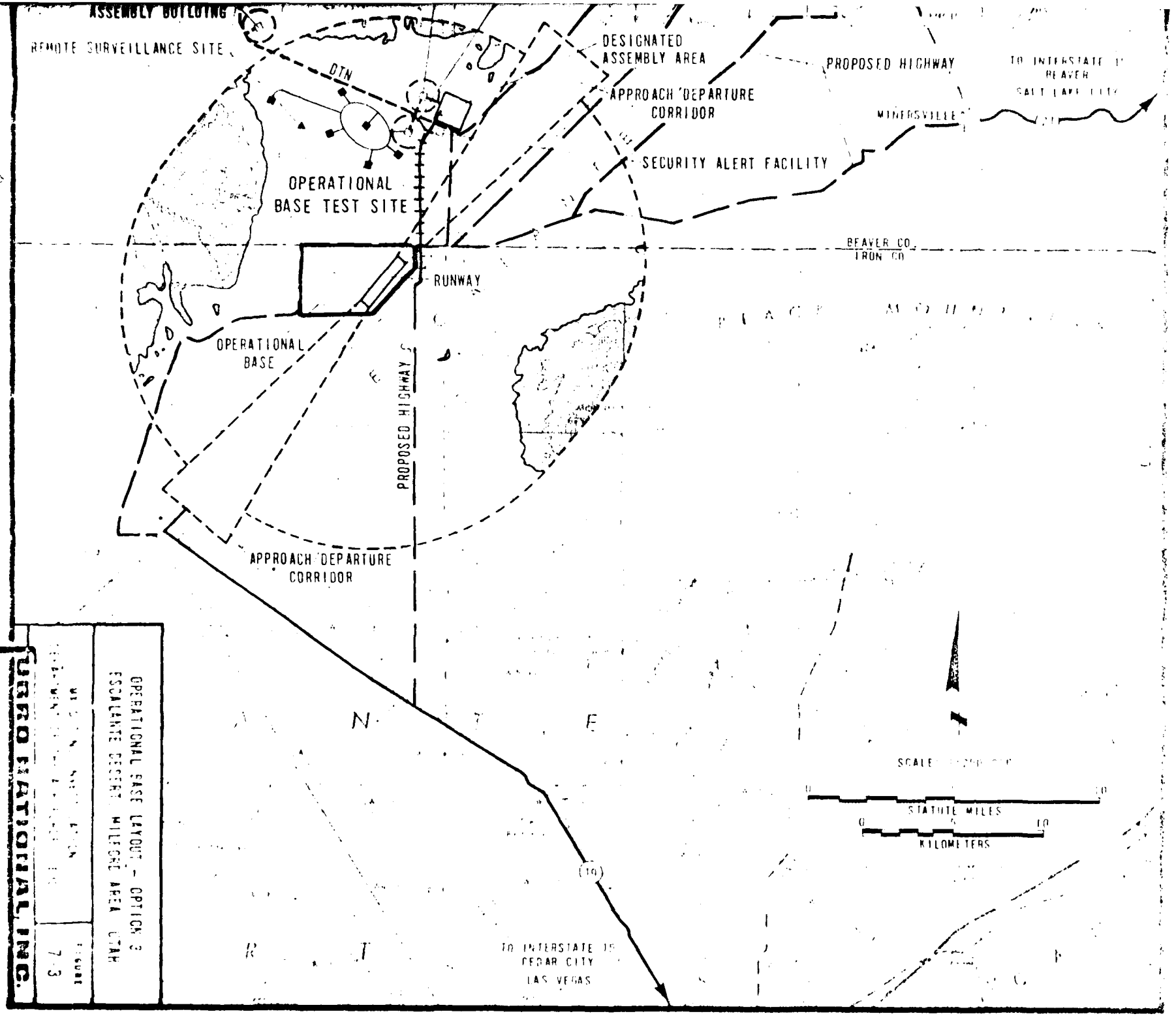
OPERATIONAL BASE LAYOUT - OPTION 2
ESCALANTE DESERT MILFORD AREA UTAH

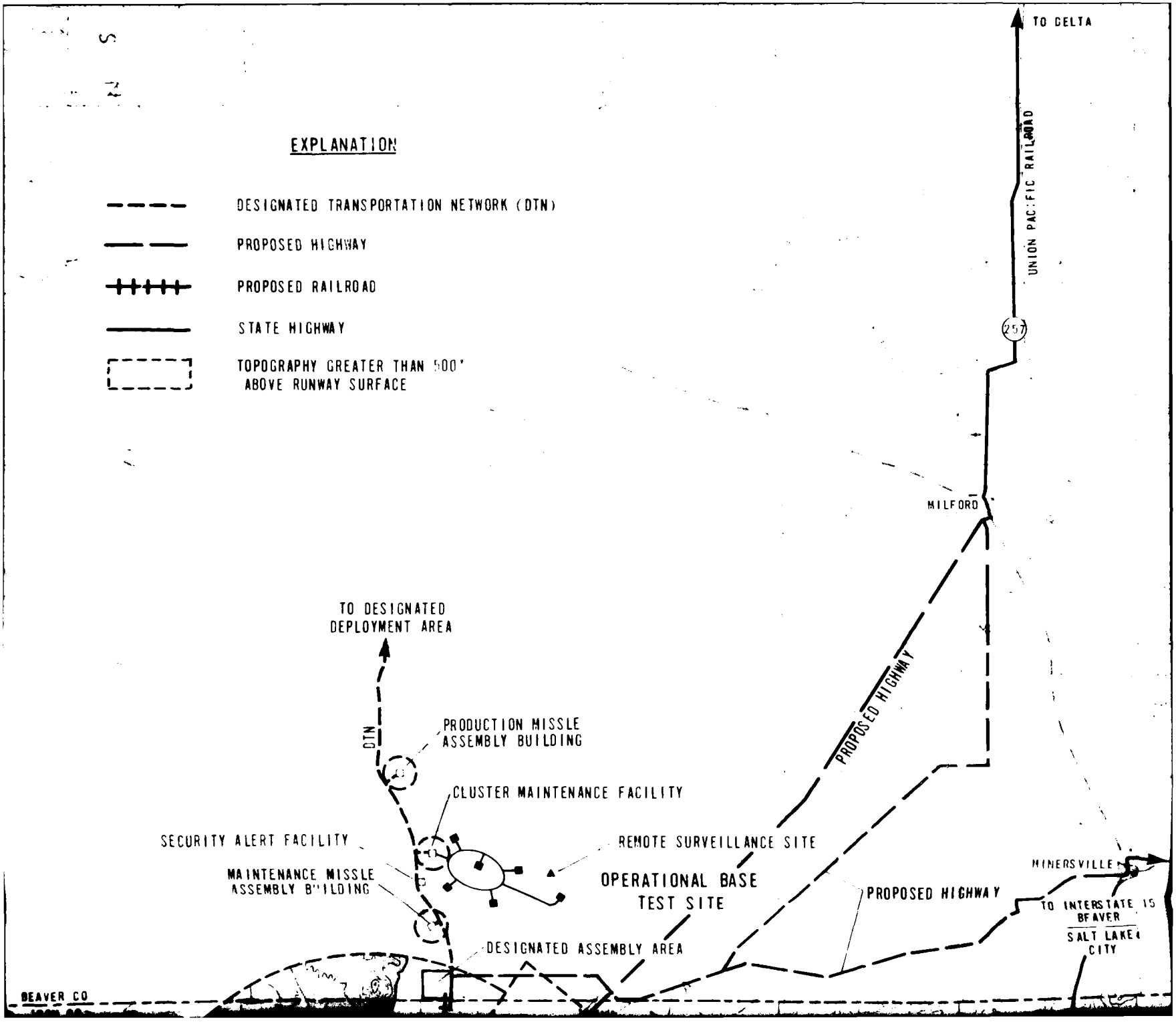
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

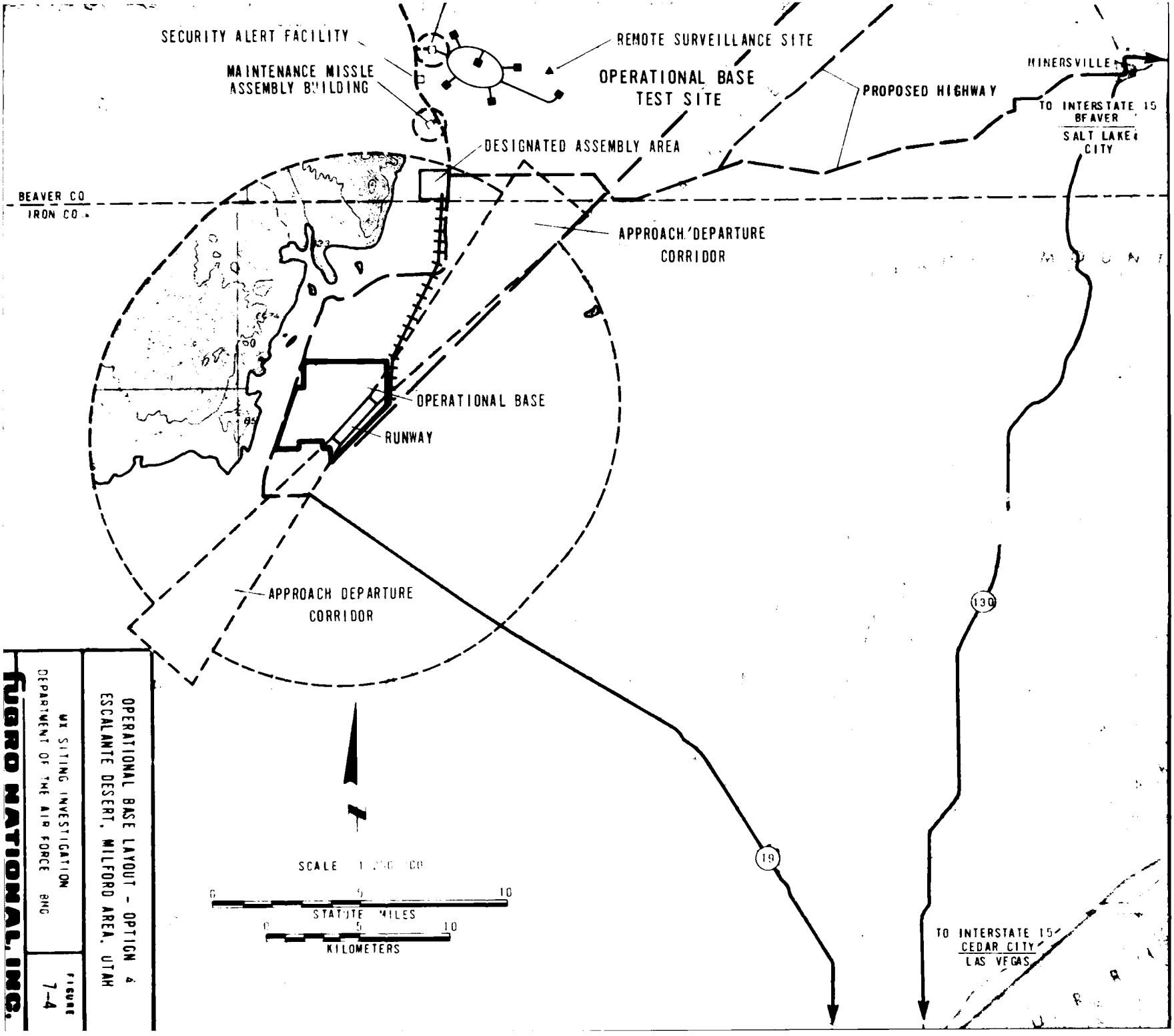
FIGURE 7-2

FUGRO NATIONAL, INC.


EXPLANATION
DESIGNATED TRANSPORTATION NETWORK (DTN)
PROPOSED HIGHWAY
PROPOSED RAILROAD
STATE HIGHWAY
TOPOGRAPHY GREATER THAN 500' ABOVE RUNWAY SURFACE
TO DELTA
UNION PACIFIC RAILROAD
MILFORD
TO DESIGNATED DEPLOYMENT AREA
MAINTENANCE MISSLE ASSEMBLY BUILDING
PROPOSED HIGHWAY
CLUSTER MAINTENANCE FACILITY
PRODUCTION MISSLE ASSEMBLY BUILDING
REMOTE SURVEILLANCE SITE
DTN
DESIGNATED ASSEMBLY AREA
PROPOSED HIGHWAY
TO INTERSTATE
BEAVER
APPROACH/DEPARTURE CORRIDOR
MINERSVILLE
SECURITY ALERT FACILITY


ASSEMBLY BUILDING
REMOTE SURVEILLANCE SITE
DTN
DESIGNATED ASSEMBLY AREA
APPROACH DEPARTURE CORRIDOR
PROPOSED HIGHWAY
TO INTERSTATE 15
BEAVER
SALT LAKE CITY
MINERSVILLE
SECURITY ALERT FACILITY
OPERATIONAL BASE TEST SITE
BEAVER CO.
IRON CO.
RUNWAY
OPERATIONAL BASE
PROPOSED HIGHWAY
APPROACH DEPARTURE CORRIDOR
N
SCALE
STATUTE MILES
KILOMETERS
(19)
TO INTERSTATE 15
CEDAR CITY
LAS VEGAS
TURNER NATIONAL, INC.
OPERATIONAL BASE LAYOUT - OPTION 3
ESCALANTE DESERT MILFORD AREA UTAH


EXPLANATION
DESIGNATED TRANSPORTATION NETWORK (DTN)
PROPOSED HIGHWAY
PROPOSED RAILROAD
STATE HIGHWAY
TOPOGRAPHY GREATER THAN 500' ABOVE RUNWAY SURFACE
TO DELTA
UNION PACIFIC RAILROAD
257
MILFORD
TO DESIGNATED DEPLOYMENT AREA
DTN
PRODUCTION MISSLE ASSEMBLY BUILDING
CLUSTER MAINTENANCE FACILITY
SECURITY ALERT FACILITY
REMOTE SURVEILLANCE SITE
MAINTENANCE MISSLE ASSEMBLY BUILDING
OPERATIONAL BASE TEST SITE
PROPOSED HIGHWAY
PROPOSED HIGHWAY
MINERSVILLE
TO INTERSTATE 15
BEAVER
SALT LAKE CITY
DESIGNATED ASSEMBLY AREA
BEAVER CO



OPERATIONAL BASE LAYOUT - OPTION 4
ESCALANTE DESERT, MILFORD AREA, UTAH

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FIGURE 7-4

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(Options 1 and 2) includes 360 acres (0.6 mi^2) of private property. It also contains 180 acres (0.25 mi^2) of land under the Color of Title Application discussed in Section 4.2. The acquisition of this property is expected to be the least expensive of the four options.

The Iron County sites, Option 3 near the county line and Option 4 near Lund, require the acquisition of more private or state land than Option 1. Option 3 contains 960 acres (1.5 mi^2) of state land and 1600 acres (2.5 mi^2) of private property. Option 4 has 2280 acres (3.6 mi^2) of private property with an additional 1200 acres (1.9 mi^2) of state land.

7.2 AIRSPACE CONSIDERATIONS

Three airfield locations have been selected based on the criteria presented in Section 3.2 and on the possible operational base locations discussed above. All topography within the unobstructed approach and departure airspace for each of these airfields is within the criteria as given. Additionally, there are no OB activity centers inside the approach/departure corridor in any of the options. The topography at right angles to the airfields, however, does not meet the criteria of being less than 500 feet above the runway surface (Figure 7-1 to 7-4, Drawing 7-1). Within the areas that should be unobstructed, there are the Shauntie Hills-Star Range, Monument Knolls, Black Mountains, Blue Knoll, and Blue Mountain-Wah Wah Mountains. The extent to which each of these ranges deviates from the regional unobstructed airspace criteria is presented in Table 7-1.

MOUNTAIN RANGE	SHAUNTIE HILLS-STAR RANGE			MONUMENT KNOLLS			BL
AIRFIELD OPTION (1)	1 AND 2	3	4	1 AND 2	3	4	1 AND 2
MAXIMUM ELEVATIONS WITHIN REGIONAL UNOBSTRUCTED AIRSPACE	5592 TO 6880 FEET	5665 TO 5689 FEET	NO IMPACT	5668 FEET	5592 FEET	NO IMPACT	NO IMPACT
HEIGHT OF RANGE IN EXCESS OF UNOBSTRUCTED AIRSPACE CRITERIA	1370 FEET	121 FEET	NO IMPACT	152 FEET	24 FEET	NO IMPACT	NO IMPACT
CLOSEST PEAK TO RUNWAY-HEIGHT IN EXCESS OF UNOBSTRUCTED AIRSPACE CRITERIA AND PROXIMITY TO RUNWAY	82 FEET / 2 MILES	119 FEET / 7 MILES	NO IMPACT	152 FEET / 8 MILES	24 FEET / 8 MILES	NO IMPACT	NO IMPACT

NOTE: (1) RUNWAY ELEVATIONS ARE AS FOLLOWS:

OPTIONS 1 AND 2	5010 FEET
OPTION 3	5068 FEET
OPTION 4	5080 FEET

LLS	BLACK MOUNTAINS			BLUE KNOLL			BLUE MOUNTAIN–WAH WAH MOUNTAINS		
4	1 AND 2	3	4	1 AND 2	3	4	1 AND 2	3	4
NO IMPACT	NO IMPACT	5630 TO 6780 FEET	NO IMPACT	NO IMPACT	5629 FEET	5629 FEET	NO IMPACT	5611 TO 7594 FEET	5667 TO 6958 FEET
NO IMPACT	NO IMPACT	1212 FEET	NO IMPACT	NO IMPACT	61 FEET	49 FEET	NO IMPACT	2026 FEET	1378 FEET
NO IMPACT	NO IMPACT	62 FEET / 5 MILES	NO IMPACT	NO IMPACT	61 FEET / 3 MILES	49 FEET / 8 MILES	NO IMPACT	1003 FEET / 5 MILES	242 FEET / 2.5 MILES

MOUNTAIN RANGES IMPACTING ON
REGIONAL UNOBSTRUCTED AIRSPACE
ESCALANTE DESERT, MILFORD AREA, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE 7-1

FUGRO NATIONAL, INC.

Airspace conditions in the study area seem to be unrestricted. The Desert Military Operations Area (MOA) is 16 miles to the southwest and should not affect the airspace. The same is true for the Sevier "B" MOA, which is 24 miles to the north. There are local landing strips, such as the ones at Milford and Cedar City, but they also should not pose a problem. The Escalante Desert is also an air corridor between Los Angeles-Las Vegas and Salt Lake City; potential conflicts between this corridor and operational base operations will need to be assessed.

7.3 TRANSPORTATION CONSIDERATIONS

With the possible operational base locations selected, the problem of providing ground transportation to the site needs to be considered. Each of the possible OB locations is adjacent to the Union Pacific Railroad, which provides easy access for the short rail spurs to the OB and DAA. The Union Pacific Railroad is built with 130 lb/yd rail, which should handle moderate to heavy freight loads. The remaining mode of transportation which needs to be considered is the highway. Although there are three potential OB sites, the destination points to which highways are needed are the same for each. These points are 1) Milford and north to Delta-Salt Lake City, 2) Minersville and east to Beaver-Salt Lake City, and 3) south to Cedar City-Las Vegas (Figures 7-1 to 7-4, Drawing 7-1). The distances from each of these population centers to the various OB locations are summarized in Table 7-2. There should be no more than the standard construction problems along any of the needed alignments including the railroad and drainage crossings. Also, the right-of-way

Option (1)	RAILROAD		HIGHWAY				DESIGNATED TRANSPOR	
	From Union Pacific to OB (2)	From OB to DAA	From Population Center to OB (with alternatives)			From OB to DAA	From DAA	
			MILFORD	MINERS-VILLE	CEDAR CITY		to Maintenance MAB	to Production MAB
1	1 (3)	6.5	7.5 (9)	12.5 (12.5)	50.5 (38.5)	5	.56 (4)	8
2	1	3	7.5 (9)	12.5 (12.5)	50.5 (38.5)	1	.56	6.5
3	.25	5.25	24 (22.5)	23 (23)	61 (37.5)	5	.56	8
4	.5	7	36 (31)	35 (35)	36 (36)	6	2	8

NOTES:

(1) See Text and Figures 7-1, 7-2, 7-3, and 7-4

(2) See Figure 3-1 for Abbreviations

(3) Distances Given Are in Statute Miles

(4) .56 Mile Represents the 2965-Foot Stand Off Distance in Miles

DESIGNATED TRANSPORTATION NETWORK (DTN)				DTN HIGHWAY		Straight Line From Maintenance MAB to Production MAB
A Production MAB	From Maintenance MAB to OBTS	From Production MAB to DDA	From OBTS to DAA	From OBTS to OB	From OB to DDA	
8	1.12	6	1.68	7	19	7.5
6.5	5.5	11.5	6.06	7	19	6
8	1.12	6	1.68	6	19	7.5
8	3	6	5	12	20	5.5

DISTANCES BETWEEN OPERATIONAL BASE COMPONENTS
ESCALANTE DESERT, MILFORD AREA, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE 7-2

FUGRO NATIONAL, INC.

would have to be obtained, especially if alignments are not along existing gravel roads.

There are no paved roads along the distance between any of the OB locations and Milford. Numerous gravel roads exist and could be upgraded into highways on both sides of the railroad. As an alternative to upgrading existing roads, a new road could be constructed parallel to the railroad from the base location to Milford. Such a road would provide the most direct route to Milford, particularly for Options 3 and 4.

Existing gravel roads provide a fairly direct route between Options 1 and 3 and Minersville. Although the OB location in Option 1 has a better quality road than Option 3, both would need to be fully upgraded and could possibly need straightening in places. If a highway is built parallel to the railroad to Milford, either Option 3 or 4 could use this road as part of the route to Minersville.

Cedar City is south of all four options. Option 4 has the most direct and least expensive route to Cedar City since it is close to Lund which is the terminus of State Highway 19 into Cedar City. Option 3 is in such a location that one could take the previously proposed highway to Minersville and then proceed down State Highway 130 to Cedar City. As an alternative to this approach, a highway could be built to the south to intersect State Highway 19, which leads to Cedar City. Cedar City can be reached from Option 1 by the road from Option 1 to Minersville. An alternate route, similar to that for Option 3, is to extend

the proposed highway paralleling the railroad to the south. This new highway would intersect Highway 19 which ends in Cedar City.

To determine which option is preferred, based on road construction, is difficult. The need to travel to one town as opposed to another must be determined. Similarly, it is necessary to consider the time saved by construction of straight line routes. If all other considerations were equal and cost per mile was the only factor, Option 1 would probably represent the least expensive solution to transportation problems, either with or without the alternative routings. Without the alternative routings, Options 3 and 4 are about equal in total mileage between towns. With the alternatives, Option 3 appears preferable to Option 4 by 20 miles.

7.4 DESIGNATED TRANSPORTATION NETWORK CONSIDERATIONS

Although four different OB configurations are being presented, the location of the production Missile Assembly Building (MAB) is generally in the same location for each. That location is in the northwestern corner of the study area at the southern end of Wah Wah Wash. From the production MAB, it is a short (6 to 11.5 miles) distance to the closest Designated Deployment Area (DDA) in Wah Wah Valley. Wah Wah Wash, through which the DTN must pass, should present only normal construction problems except for some adverse terrain at the southernmost end. From Wah Wah Valley, the rest of the DDA can be reached either by using State Highway 21 as the Designated Transportation Network (DTN) to the

west and/or by construction of a DTN to the north into Tule or Whirlwind valleys. To attempt a DTN in any other manner to the north or west would mean either doubling back past the Designated Assembly Area (DAA) and operational base facilities and/or increasing the distance to the nearest DDA. The next DDA valley to the west could be reached by going south and west along Jockey Road or Pine Valley Road for distances of 22 miles or 42 miles, respectively. State Highway 21 could also be reached by traveling east and north to Milford. This would increase the distance to the DDA by 40 miles and the DTN would come within 3 miles of the Milford city limit.

The DTN alternatives are presented only in the event that the alunite mining operation in Wah Wah Wash becomes operational and there is a problem with co-existence. If the alunite mine were operating today, the DTN or a road to the production MAB would have to cross the mine's railroad line at least once. The DTN would then pass to the east of the main mining operation before intersecting Highway 21. The one or two clusters to be built south of Highway 21 would have to be designed around the mine's planned water-well system and ponds. As a positive point, the mine's railroad line could be used as the required rail spur for the operational base and DAA in Options 1 and 2 and the DAA in Option 3.

7.5 OPERATIONAL BASE TEST SITE LOCATION

The location selected for the OBTS is the same in all four options (Figures 7-1 to 7-4). This site was selected for the

OBTS because it is wholly within BLM land and is in an isolated position relative to the Union Pacific Railroad. An alternative location for the OBTS was to the west of Wah Wah Wash (assuming the DTN is to the east). Once the rock/non-rock limits were determined, the available area was 7 miles long by approximately 1 mile at its widest point. This did not take into account the property requested by the Alumet Company or its railroad which is on the western side of the wash. A second alternative was to purchase private property at the opposite end of the study area, depending on which OB option was selected. This would place any OBTS in non-isolated areas near the railroad. A third alternative would be to use some of the area occupied by the DDA in Wah Wah Valley. If the DDA starts north of Highway 21, some area west of the Alument water well system but south of Highway 21 could be used for the OBTS. As previously stated, the single OBTS location presented in all the options seems to be the best.

7.6 OPERATIONAL BASE LAYOUT - OPTION 1

The OB configuration Option 1 is shown in Figure 7-1 and Drawing 7-1. The OBTS has been located as discussed above. Option 1 places the DAA 5 miles southwest of the OB (Table 7-2) along Jockey Road, a gravel road which would need upgrading. The maintenance MAB and Cluster Maintenance Facilty (CMF) are also along Jockey Road. The rest of the OBTS is laid out to the east. The Security Alert Facility (SAF) is situated to the east and is on the same side of the road as the CMF. The production MAB is 7.5 miles up Wah Wah Wash from the maintenance MAB. This

configuration minimizes the distances between the DAA, maintenance MAB, and the OBTS.

7.7 OPERATIONAL BASE LAYOUT - OPTION 2

Option 2 (Figure 7-2) is based on the same location for the OB, OBTS, and DTN (to the DDA) as Option 1. The difference in this option is that the DAA has been located only 1 mile west of the OB to minimize travel distance (Table 7-2). The maintenance MAB is south of the DAA by a minimum of 2965 feet (the standoff distance). The maintenance MAB is still north of Jockey Road. The maintenance MAB is 5.5 miles west of the CMF and the OBTS. The production MAB is 6 miles from the maintenance MAB and 85 miles from the OB; it is also 11.5 miles south of the DDA. All facilities have been located on BLM land as much as possible.

7.8 OPERATIONAL BASE LAYOUT - OPTION 3

Option 3 (Figure 7-3) does not use the same OB location as Options 1 and 2, but it does use the same DAA, maintenance MAB, OBTS, and production MAB. The OB is in the center of the study area along the railroad. The DAA is 5 miles north of the operational base. To be closer to the operational base, the DAA would not only be under the approach/departure corridor, but it would be on state and/or private property. All other distances would be the same as in Option 1 except that the production MAB would be 13 miles north of the OB (Table 7-2).

7.9 OPERATIONAL BASE LAYOUT - OPTION 4

Option 4 (Figure 7-4) uses the same production MAB as Options 1 and 3. It also uses the same area for the OBTS as all the other

options only the CMF has been located to the west. Generally, Option 4 is more of a north-south layout than the east-west or southeast-northwest layouts of the other operations. The OB is at the southern end of the study area, along the Union Pacific Railroad. The DAA is 6 miles north of the OB, if the road follows the rail spur. A DAA alternative could be located a mile north of the OB, also on BLM land. The southern DAA location minimizes the distance to the OB. It also has more BLM land for expansion. The DAA site presented in Option 4 is on a single square mile of BLM land, but does minimize the distances to the two MABs and the OBTS. The maintenance MAB is 2 miles north of the DAA. Another 3 miles to the north is the CMF and the OBTS. The production MAB is situated 3 miles north of the CMF and 14 miles from the OB (Table 7-2).

8.0 CONCLUSIONS

Based on the preceding discussions, it is possible to reach the following preliminary conclusions regarding the suitability of the Milford study area for an operational base site:

- In general, the Milford area has sufficient area for the layout of the operational base and its components. This area becomes limited to four OB options when one attempts to place the sites on BLM land. Of these four options, Options 1 and 2 use the least state and private property. Option 4 contains the most non-BLM land. It was not possible to site entirely on BLM land.

- There are some areas of adverse terrain and flooding potential within the study area, but these can be avoided or mitigated. Additionally, there are potentially active faults in the southern portion of the study area. Further consideration will have to be given to Option 4 in regard to these faults. The OB options have potential fault-related features within them. These were detected on aerial photos and will need further field study to verify their existence. It is expected that potential problems associated with faults can be mitigated by proper placement of critical structures and by using appropriate seismic design.

- Ground water in the Escalante Desert, and especially the Milford study area, is of suitable quality for use during OB construction and operation. The quantity of available water needs further evaluation, but it appears that the area is being over used and purchase from existing users will probably be necessary. The withdrawal of ground water will need to be carefully planned and the possible further lowering of the water table investigated.

- It is not possible to site an OB which fully complies with the guidelines for regional unobstructed airspace. The area of obstructed airspace is approximately equal for all options. Option 3 has more limited use of its airspace because the obstructed airspace is equally divided both northwest and southeast of the runway. The other options have obstructed airspace only to the northwest which leaves the southeastern airspace generally unobstructed.

- The location of the OB layout and the OB proper is flexible. Four possible configurations have been presented here; final configurations can only be developed after all trade-offs have been considered. There are positive and negative aspects to each option. Transporation, both rail

and highway, and local community impacts should be considered before final site selection is made.

METRIC CONVERSIONS

Because of the large number of distance figures presented in this report, it was felt that presentation of metric equivalents within the text would result in cumbersome reading. Therefore, the metric conversions are presented below for convenience.

1 foot	= 0.3048 meters
1 mile	= 1.6093 kilometers
1 acre	= 0.4047 hectares
1 $mile^2$	= 259 hectares or 2.59 km^2
1 acre foot	= 1233 $meters^3$

LIST OF ABBREVIATIONS

AFM	Air Force Manual
ASL	Above Sea Level
BLM	Bureau of Land Management
BMO	Ballistics Missile Office
CMF	Cluster Maintenance Facility
DAA	Designated Assembly Area
DDA	Designated Deployment Area
DLE	Desert Land Entry
DNWR	Desert National Wildlife Range
DTN	Designated Transportation Network
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
IPP	Intermountain Power Project
MAB	Missile Assembly Building
MOA	Military Operation Area
OB	Operational Base
OBTS	Operational Base Test Site
RSS	Remote Surveillance Site
SAF	Security Alert Facility

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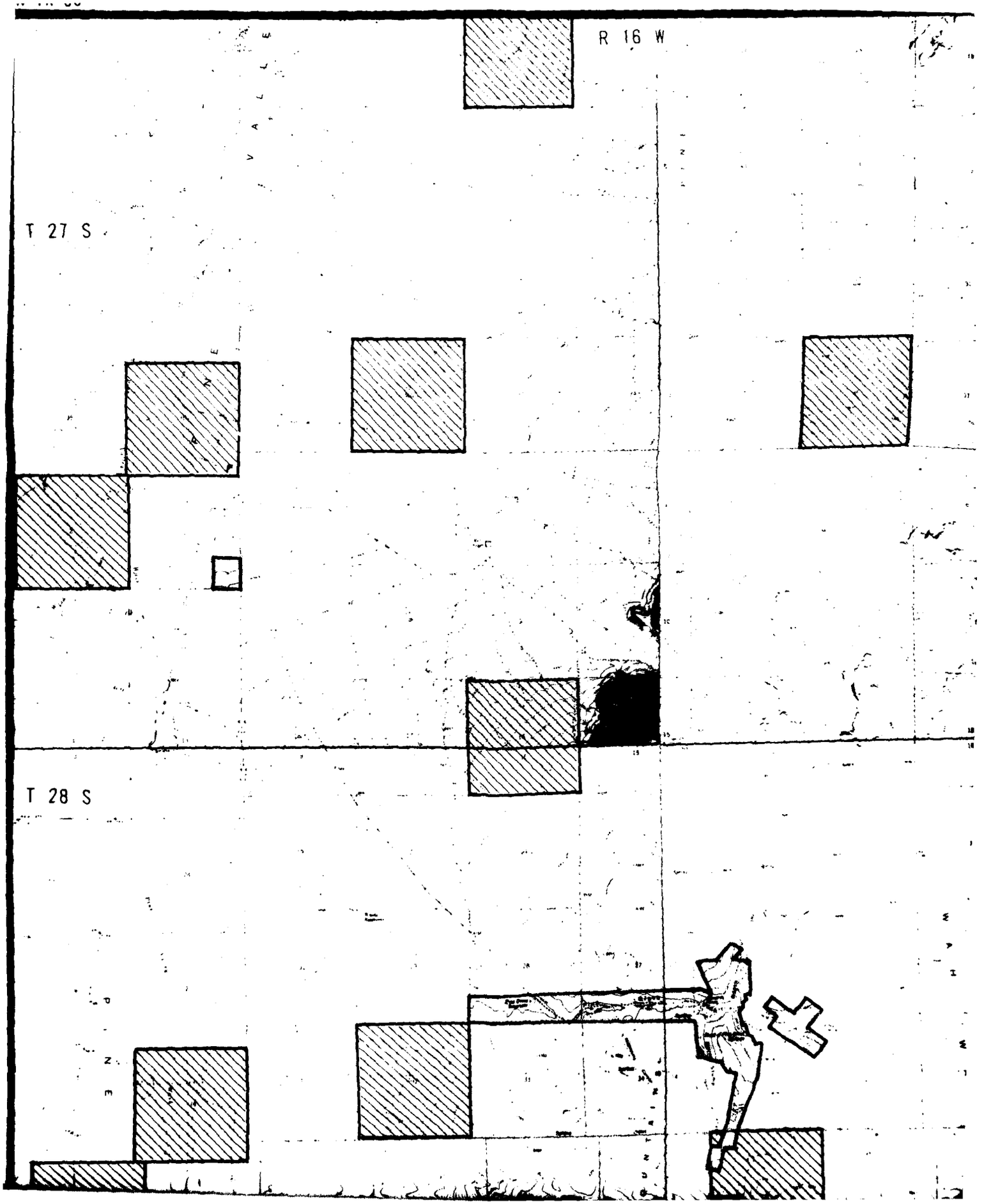
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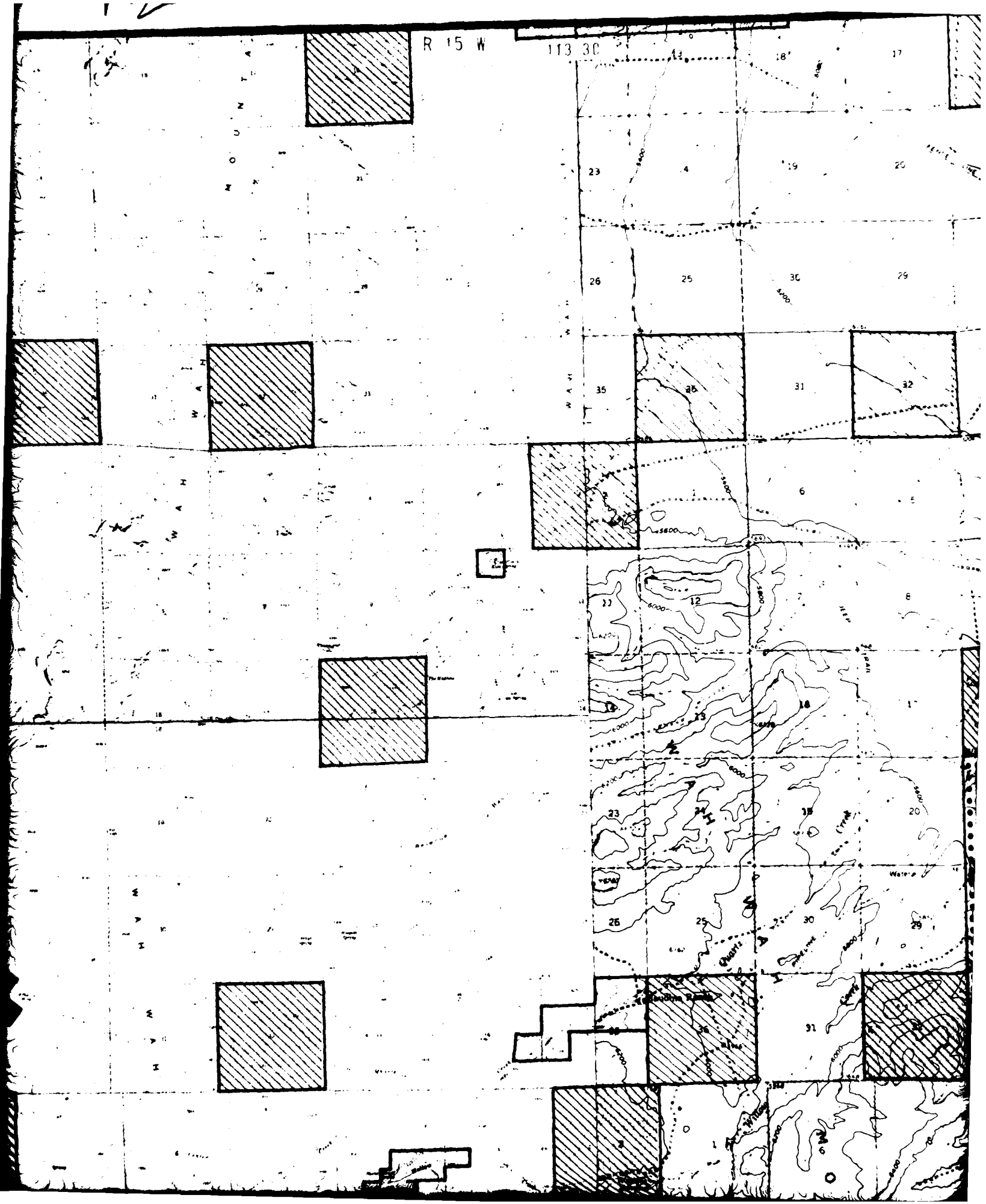
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Water
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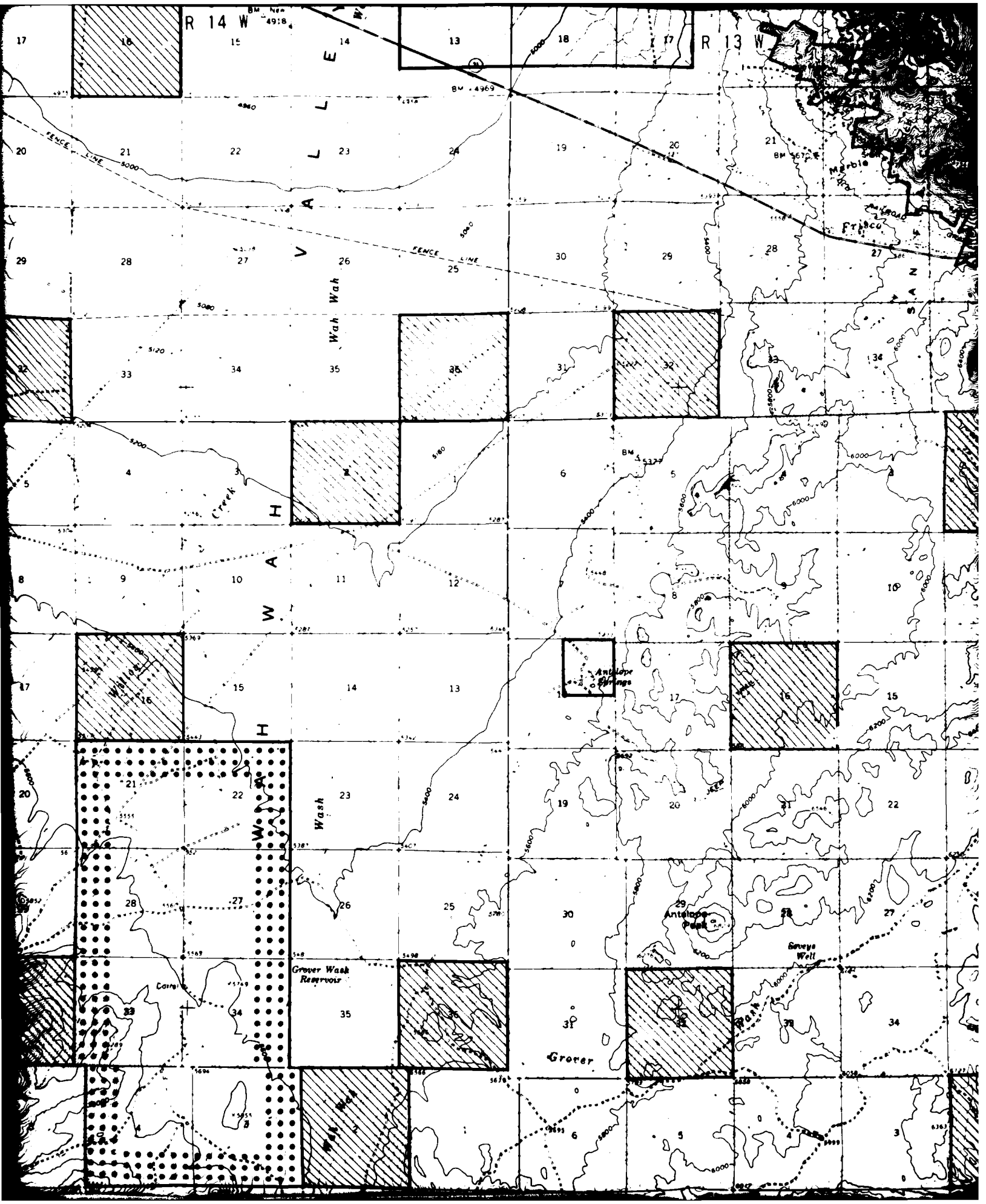
Willow Creek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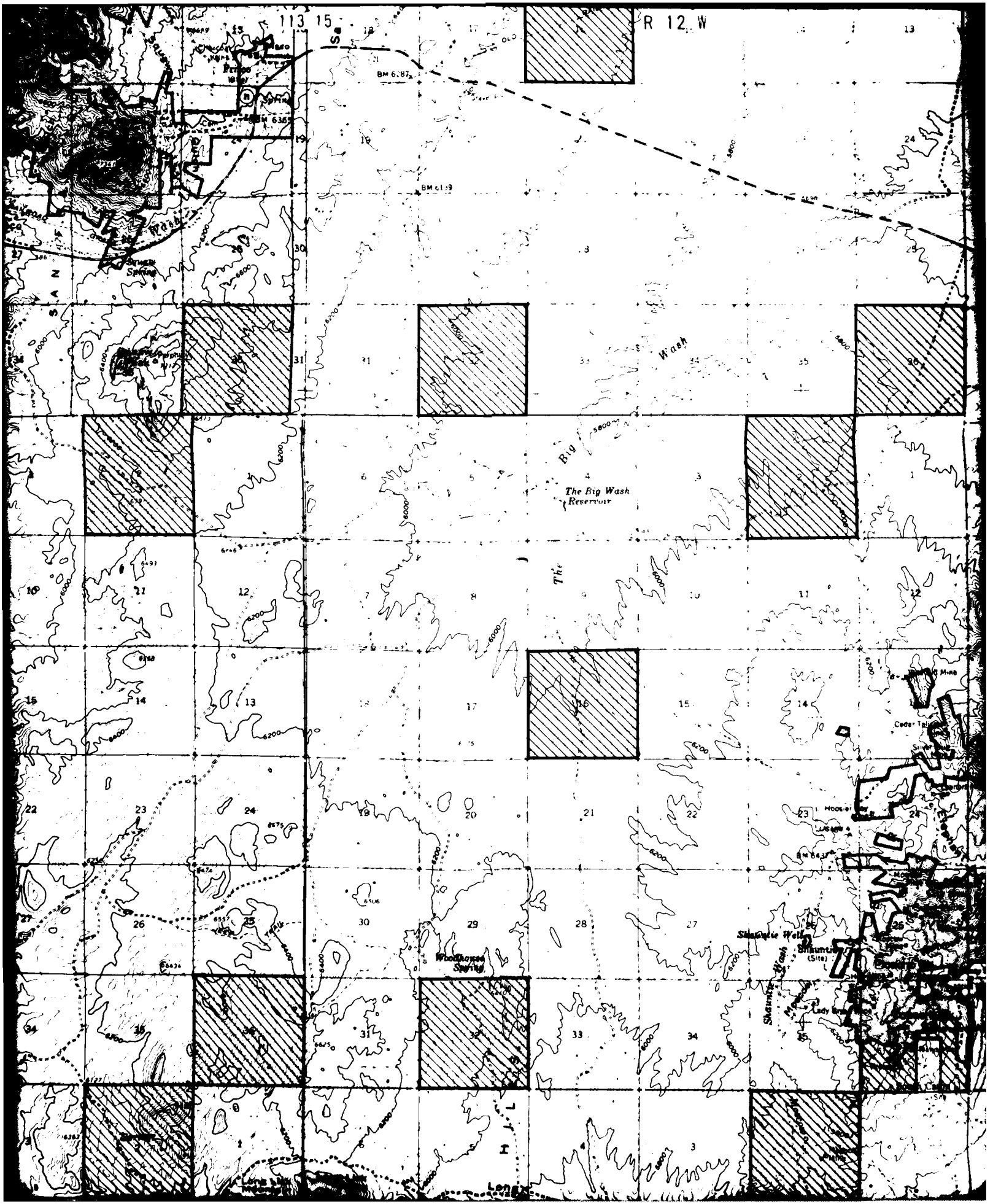
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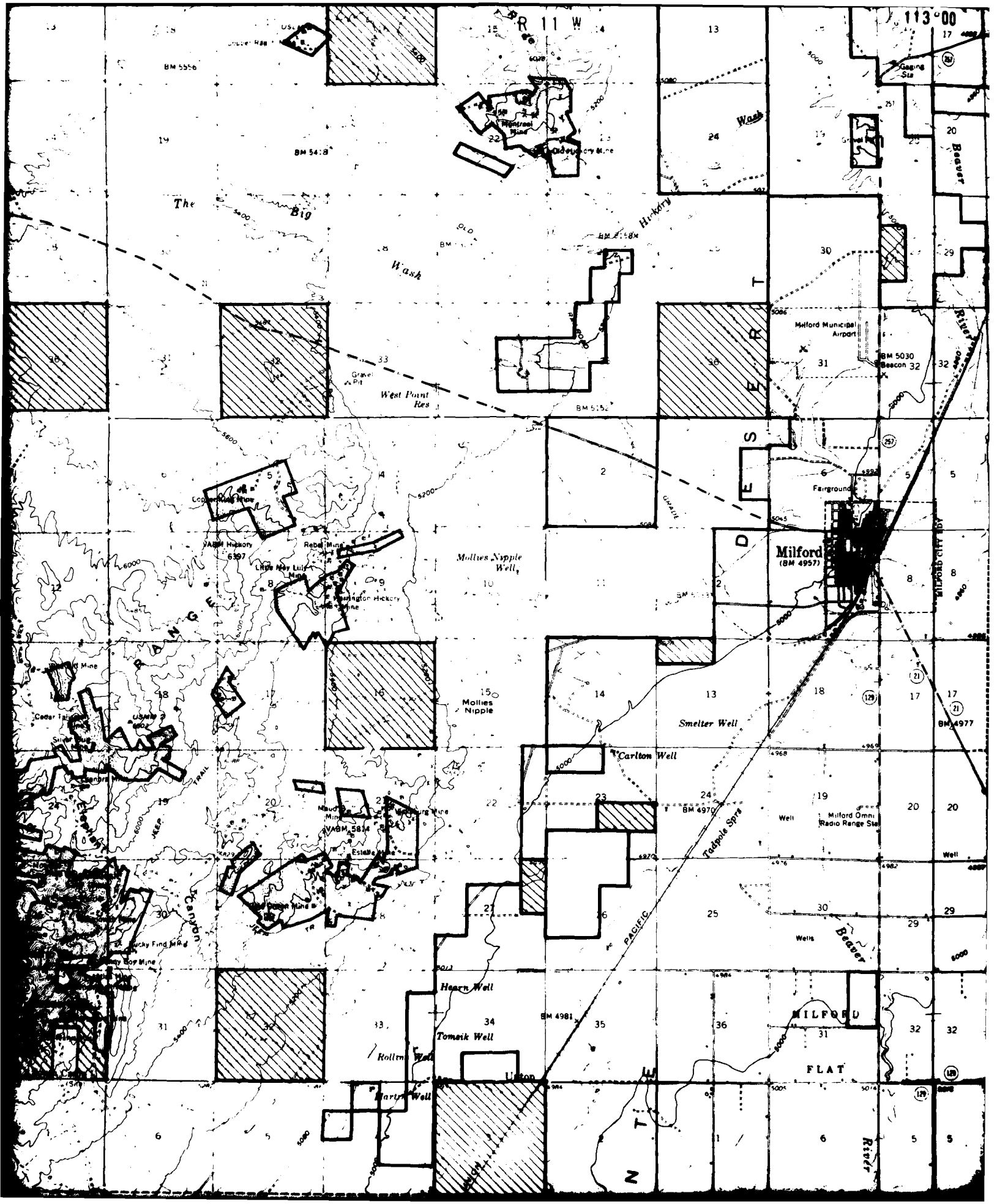
Spring
Cedar Tank
Lone Mtn.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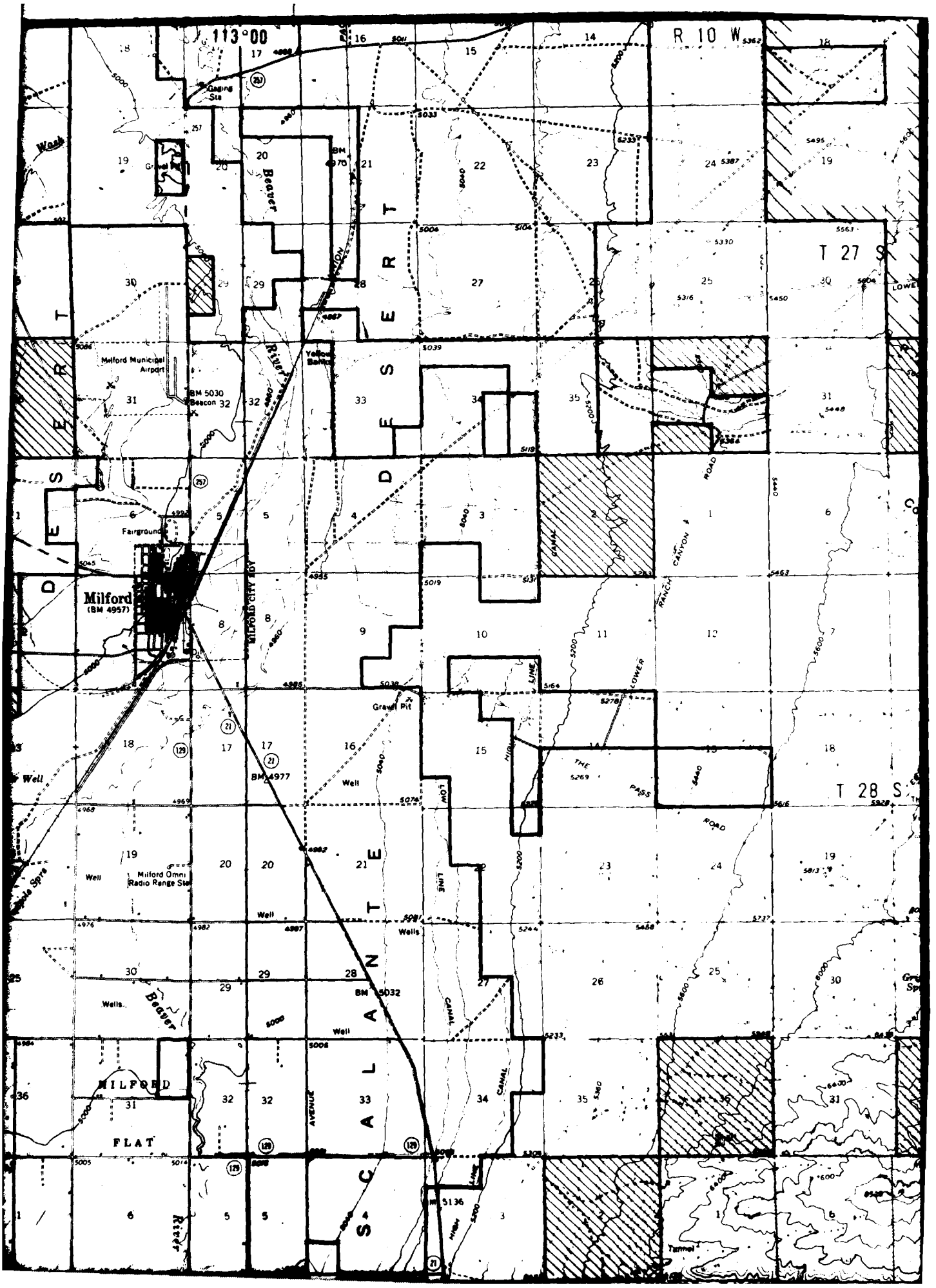
113°00
Milford
(BM 4957)
Milford Municipal Airport
Fairgrounds
Milford Omni Radio Range Sta
Milford Flat Road
Beaver River
Wash
The Big Wash
Hickory
West Point Res
Gravel Pit
Mollies Nipple
Mollies Nipple Well
Smelter Well
Carlton Well
Tadpole Spring
Hearn Well
Tomsik Well
Rollins Well
Hartley Well
Union
Pacific
Canyon
Trail
Cedar Tailings
Wells
Milford Flat
BM 4977
BM 4970
BM 4981
BM 5030
Beacon
BM 5556
BM 5418
BM 5158
BM 5086
BM 4984
BM 5074
Gaging Sta
Rebel Mine
Little May Lulu Mine
Washington Hickory Mine
Maud Mine
Estella Mine
Lucky Find Mine
Boy Mine
USMM 6397
USMM 5814
USMM 6002
VABM Hickory
VABM 5814
6397
5814
6002


113°00
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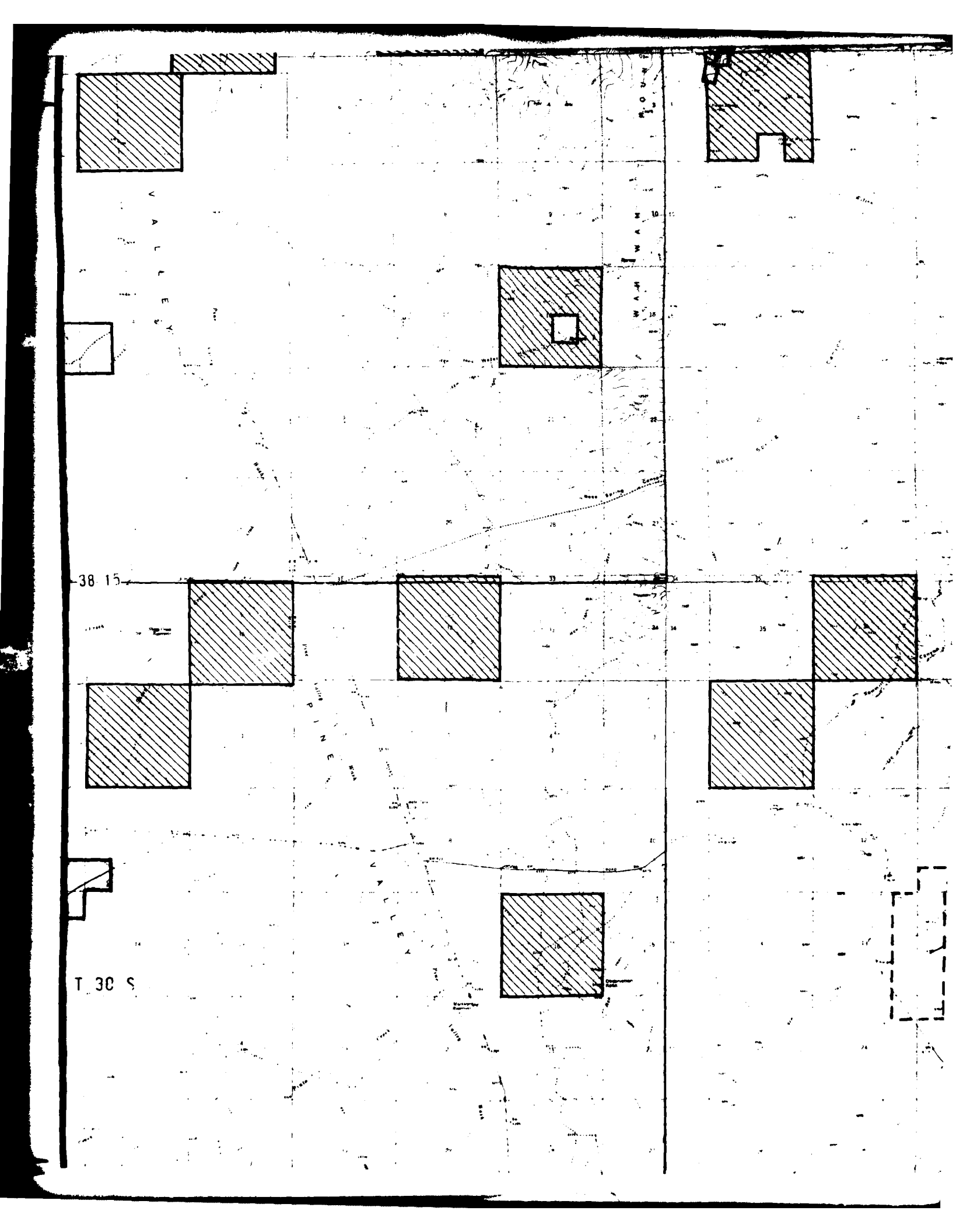
T 28 S
DESERT
SCALANTE
DESERT
Milford
(BM 4957)
Milford Municipal Airport
BM 5030
Beacon
Fairgrounds
Gaging Sta
Gravel Pit
Well
BM 4977
Milford Omni Radio Range Sta
BM 5032
MILFORD FLAT
Beaver
Wash
Beaver River
Yellow Banks
MILFORD CITY 40
CANAL
ROAD
CANYON
RANCH
LOWER
PASS
THE
LINE
AVENUE
Tunnel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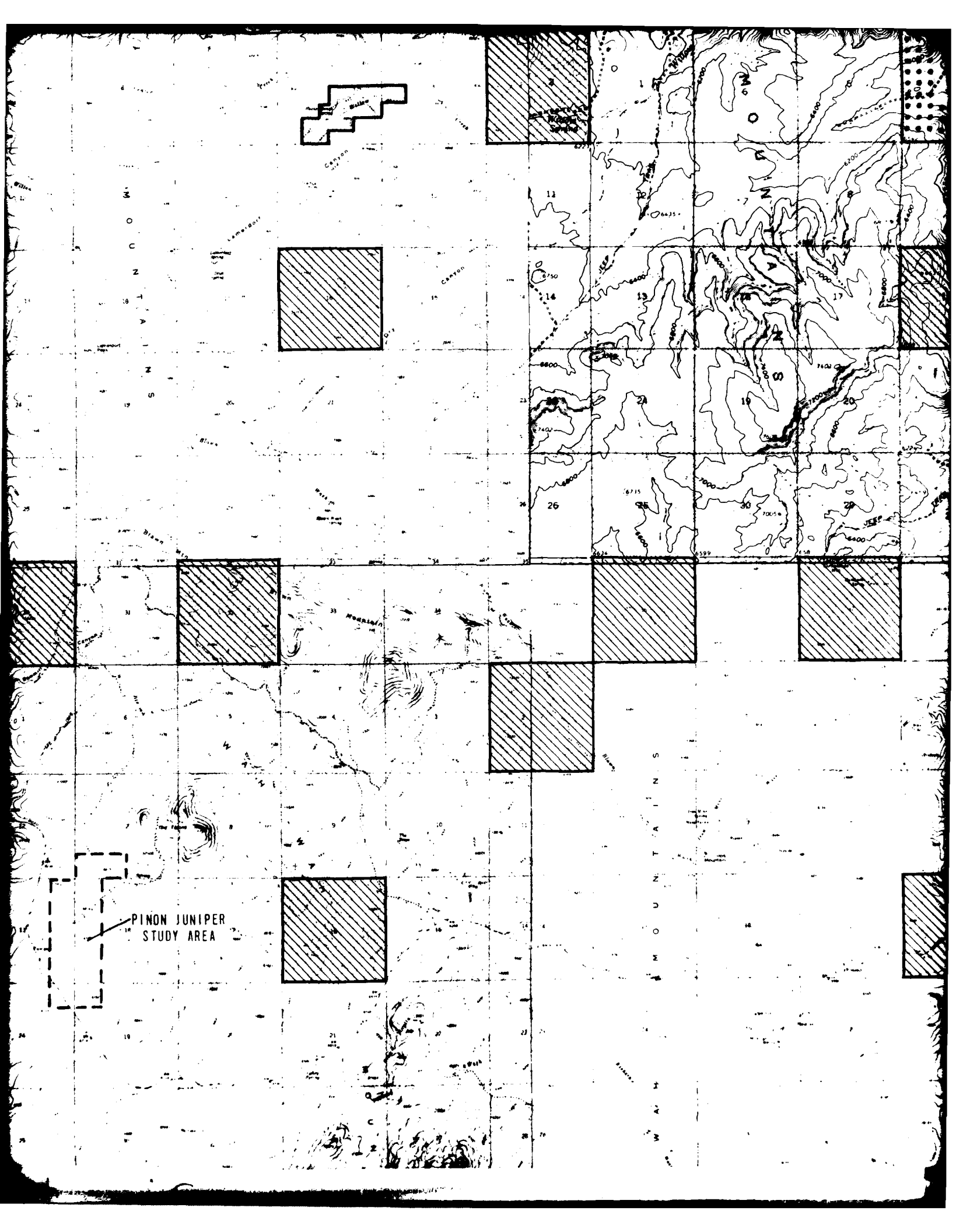
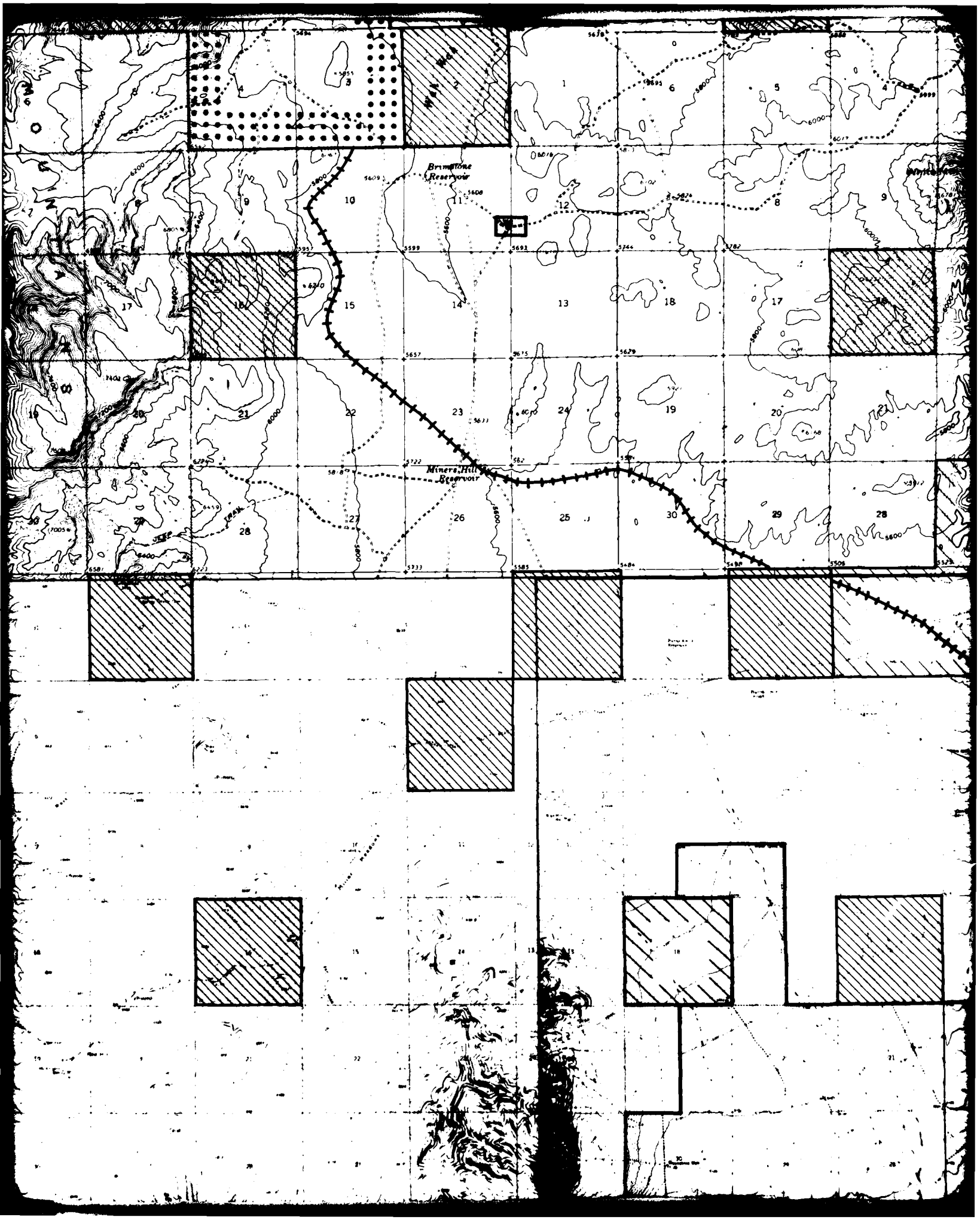
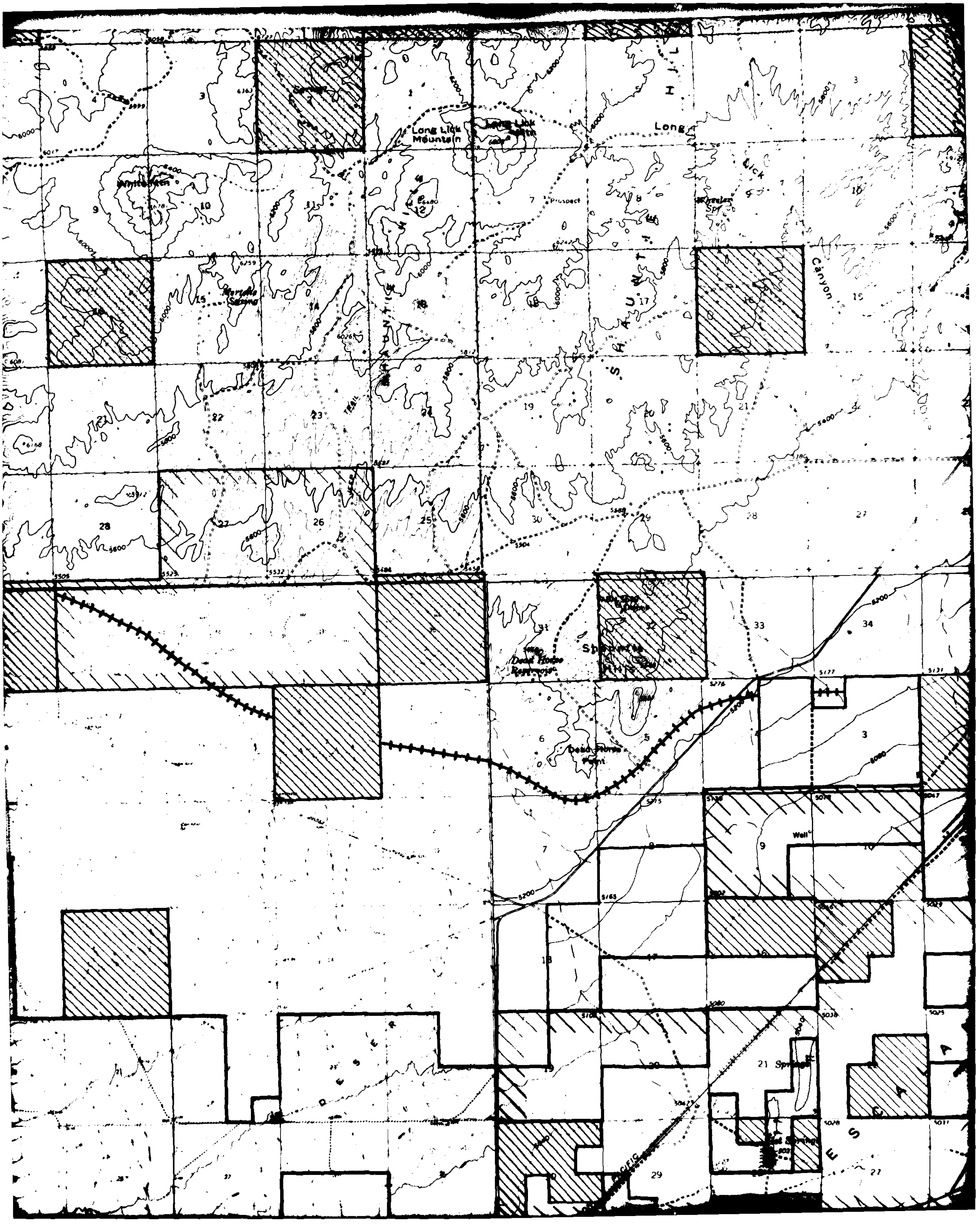
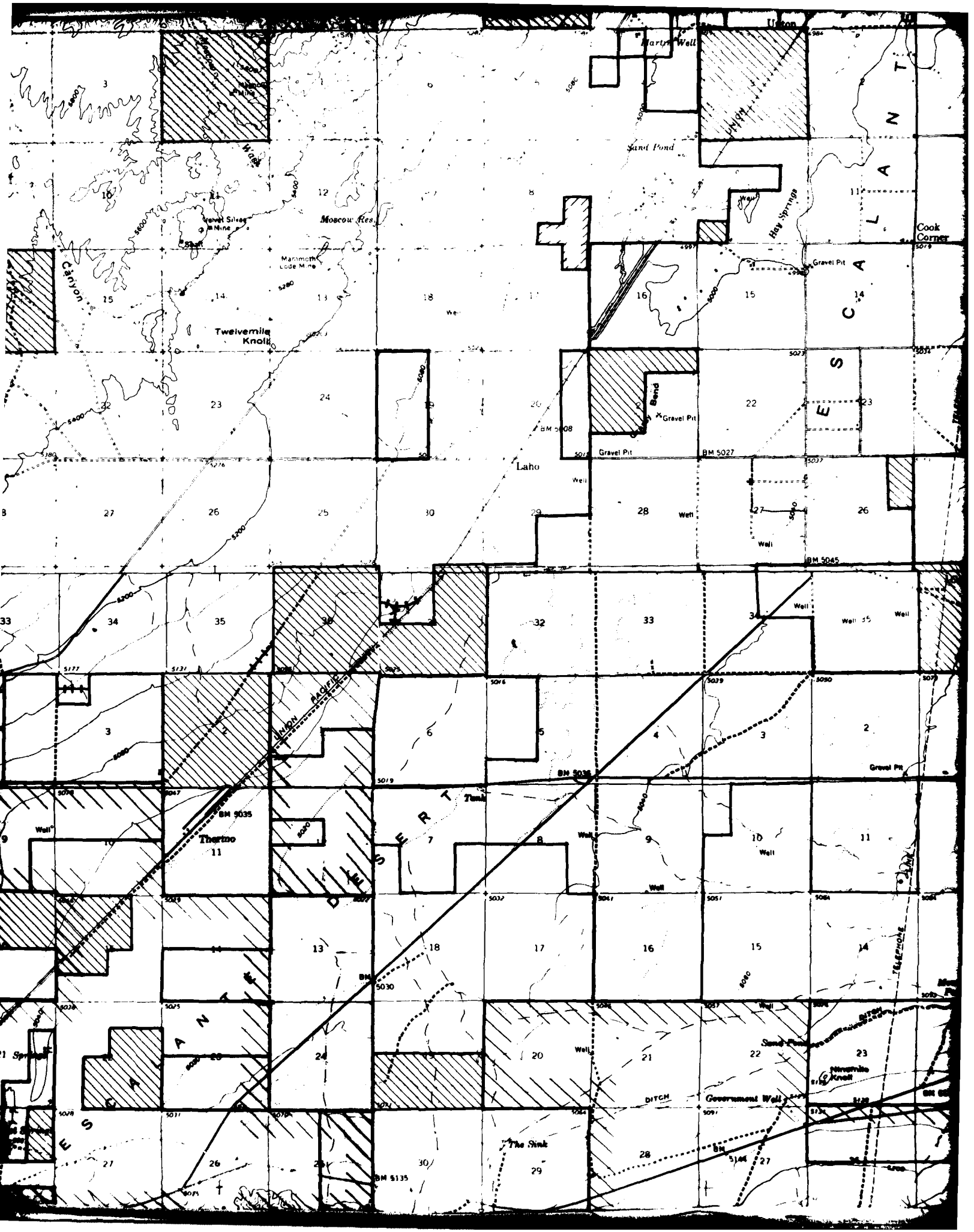
T 30 S

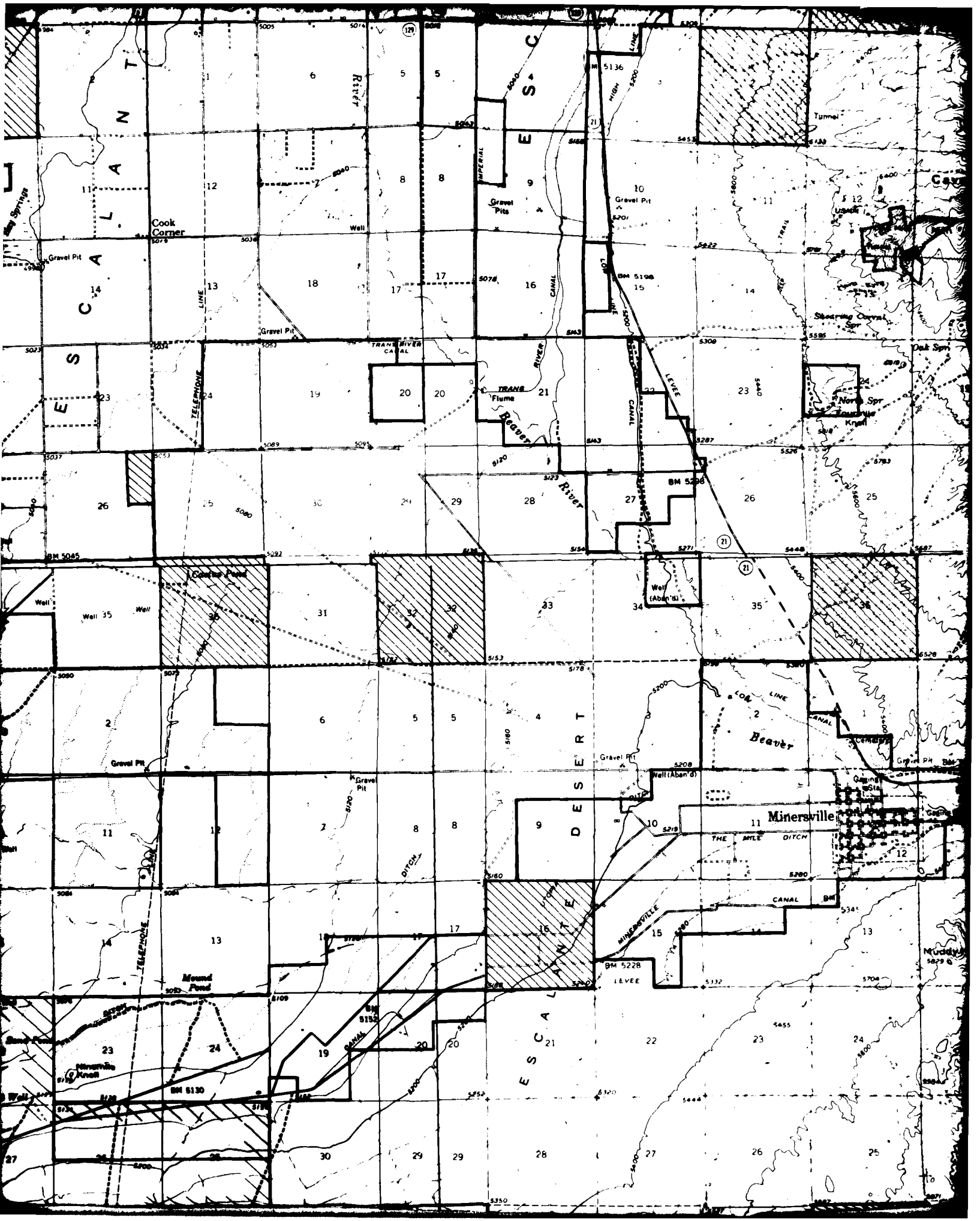

PINON JUNIPER
STUDY AREA

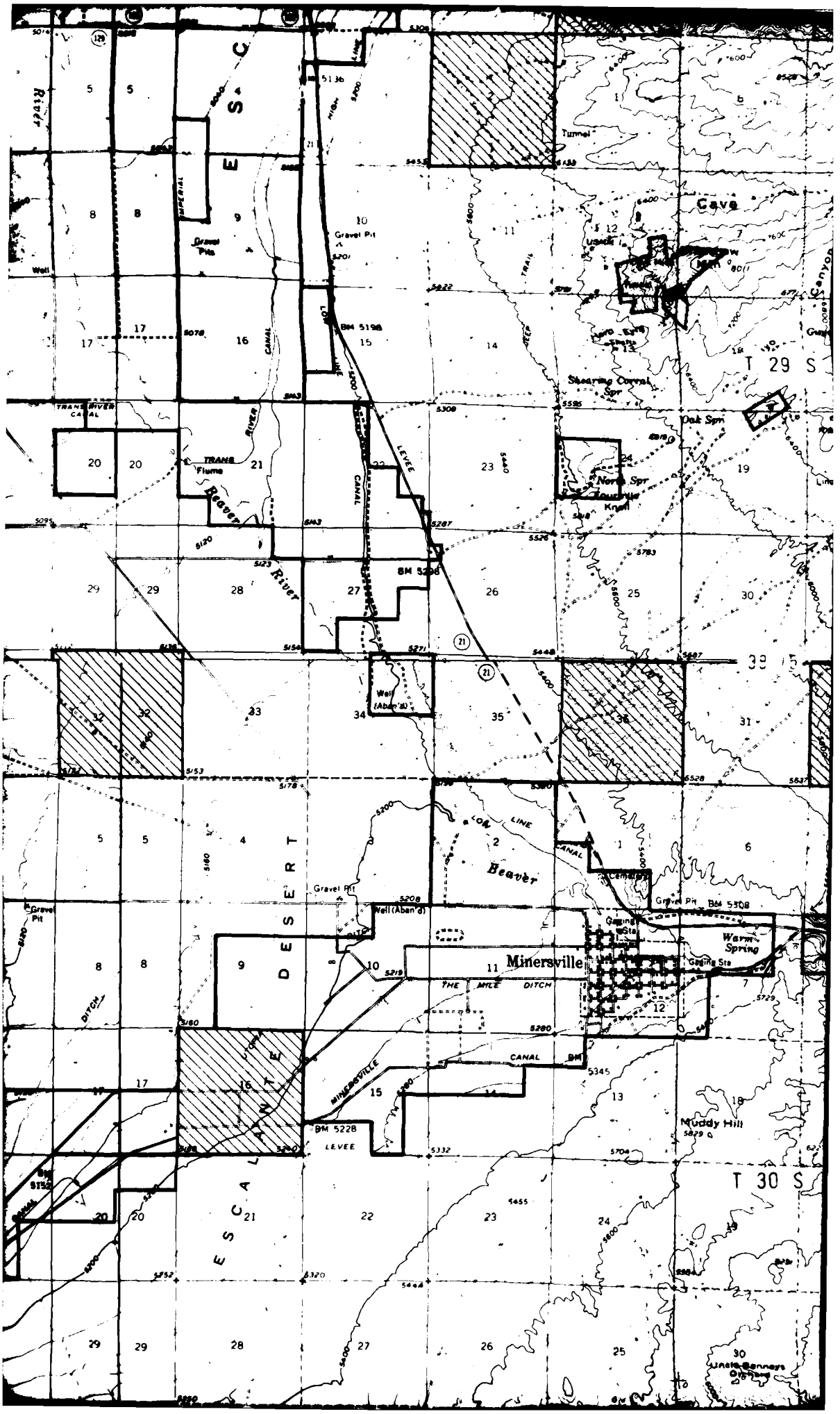

Brimstone Reservoir
Miners Hill Reservoir



Long Lick
Mountain
Long
Lick
Canyon
Prospect
TRAIL
Dead Horse
Reservoir
Dead Horse
Point
Well
Spring
PACIFIC


Union
Martin Well
Sand Pond
Hay Springs
Cook Corner
Gravel Pit
Moscow Res.
Gravel Silver Mine
Mammoth Lode Mine
Canyon
Twelvemile Knoll
Bend
Gravel Pit
BM 5008
Gravel Pit
BM 5027
Lahc
BM 5045
Union Pacific Railroad
BM 5035
Thermo
Tank
Gravel Pit
BM 5030
DITCH
Government Well
The Sink
BM 5135
TELEPHONE
DESERT
ESCALANTE


ESCALANTE DESERT
Cook Corner
Gravel Pit
Well
Gravel Pits
BM 5136
BM 5198
BM 5208
BM 5228
BM 5130
BM 5045
Tunnel
Trail
Telephone Line
Trans River Canal
Trans River Flume
Beaver River
Levee
Canal
Steaming Corral Spr
Oak Spr
North Spr
Knoll
Center Pond
Well (Aban'd)
Well 35
Beaver
Minersville
The Mile Ditch
Ditch
Minersville Canal
Levee
Mound Pond
Sand Pond
Minersville Knoll
Muddy


T 29 S
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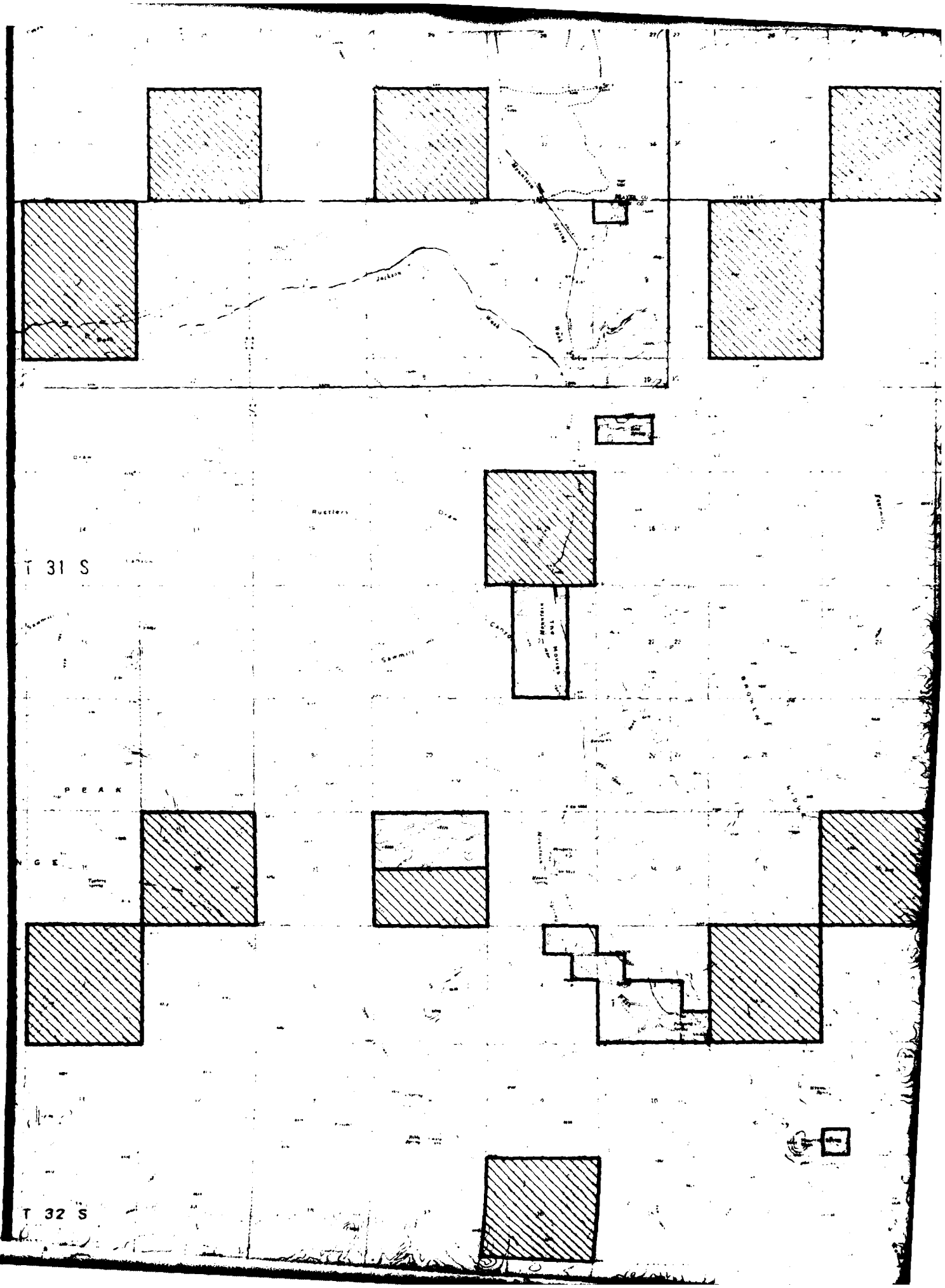
Minersville
Beaver
Warm Spring
Gaging Sta
Gravel Pit
Well (Aban'd)
BM 5308
BM 5298
BM 5228
Muddy Hill
Cave
Oak Spr
Shearing Corral Spr
Tunnel
Trans River Canal
Flume
Low Line Canal
The Mile Ditch
Levee
Minersville Canal
Escalante Desert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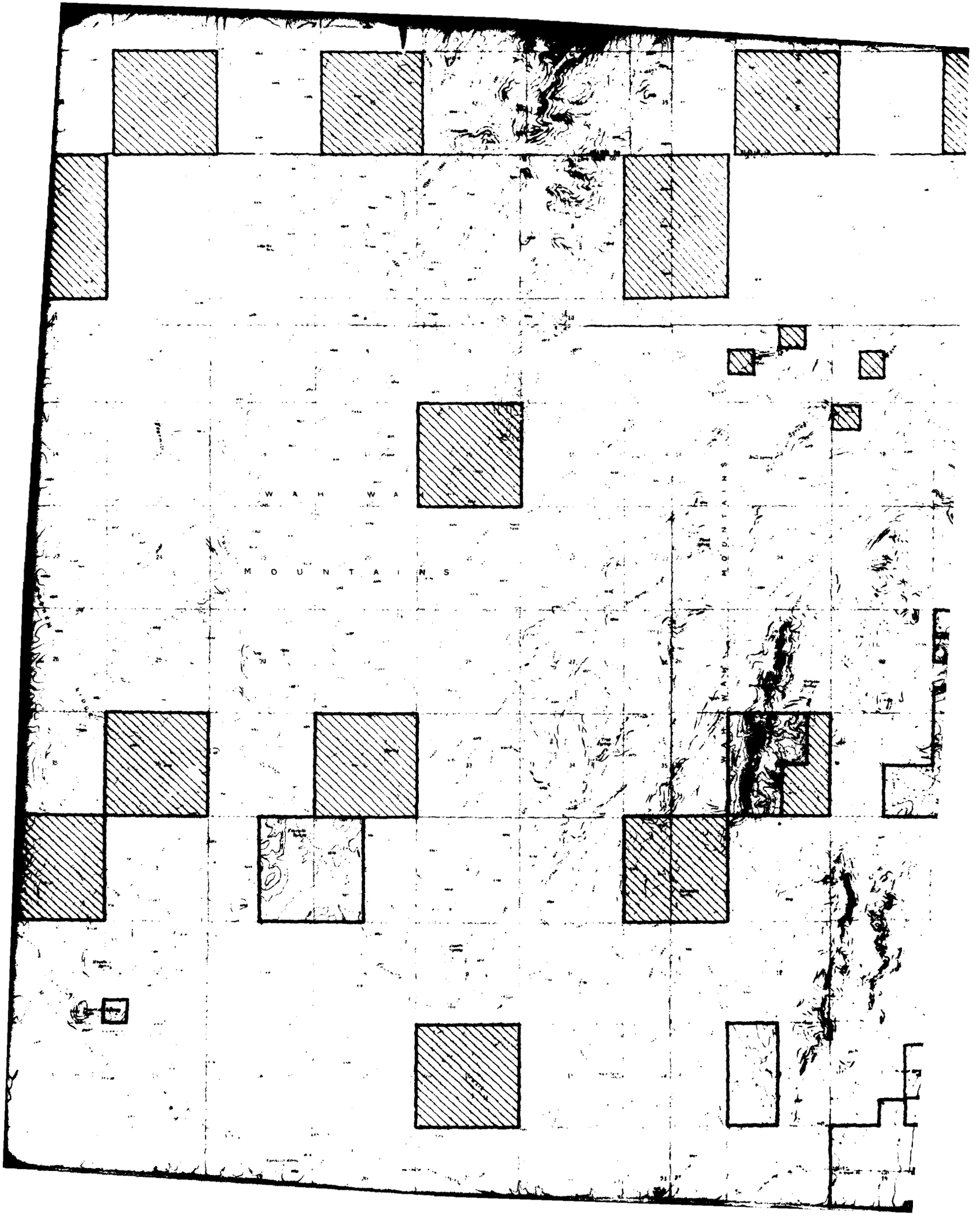
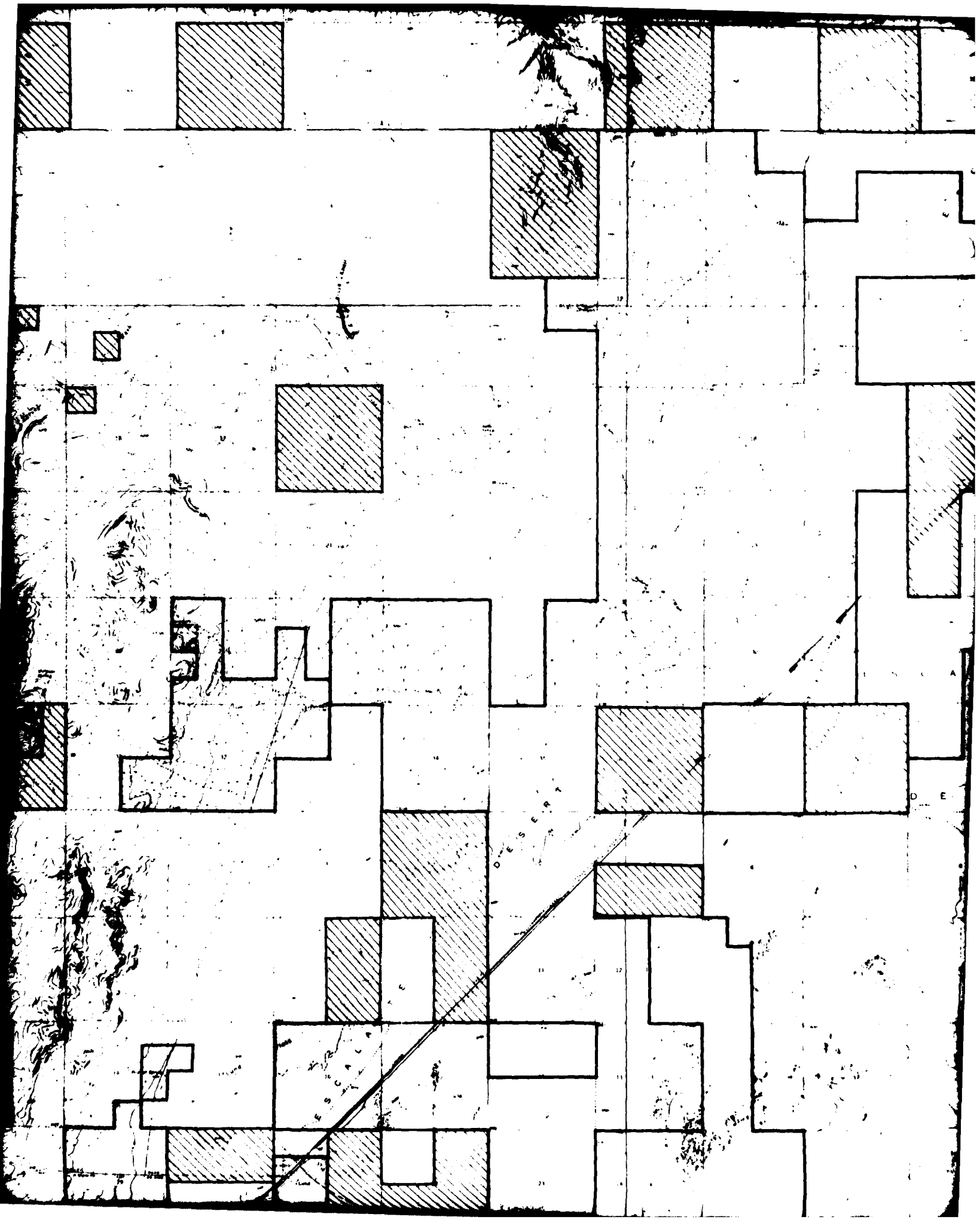
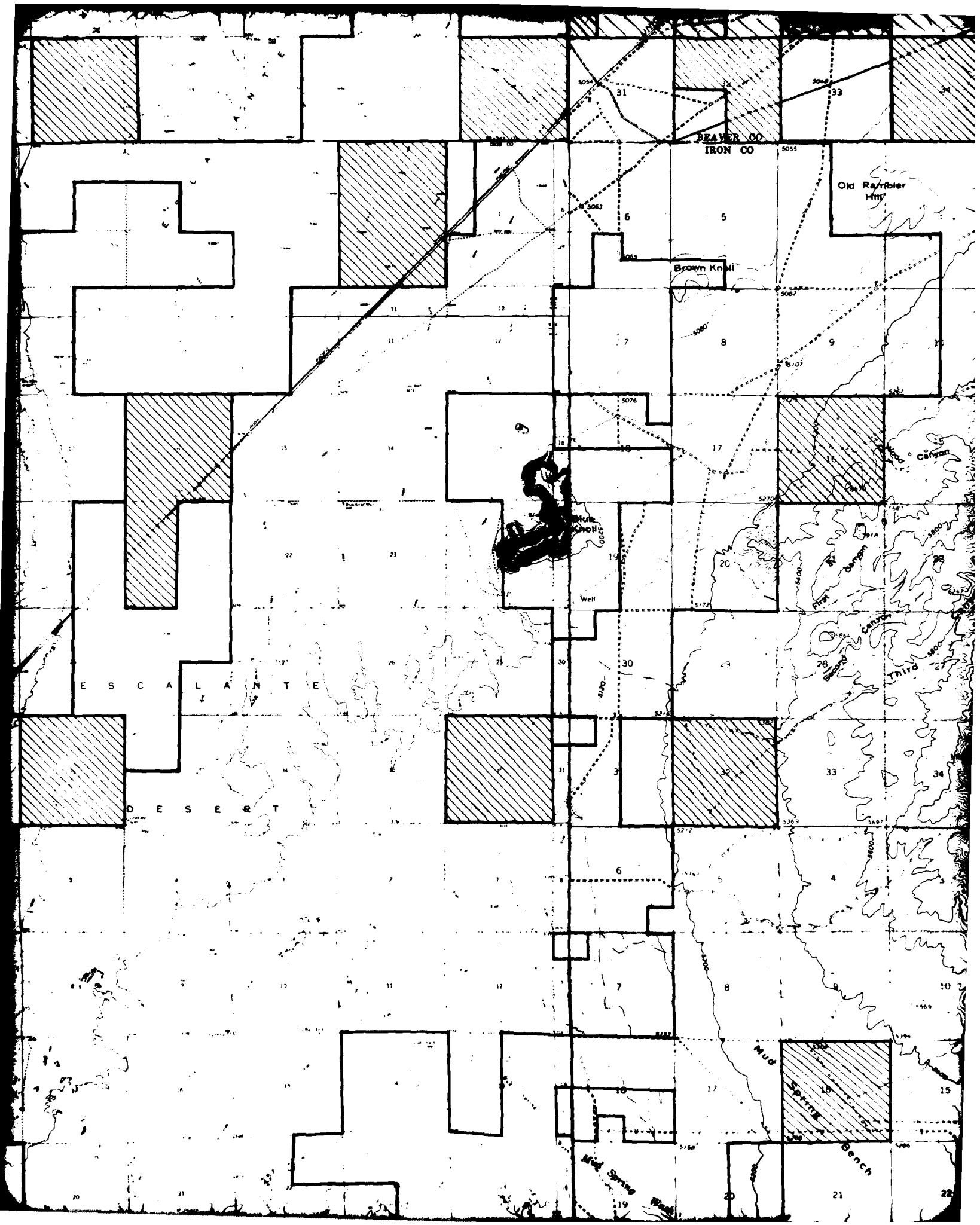
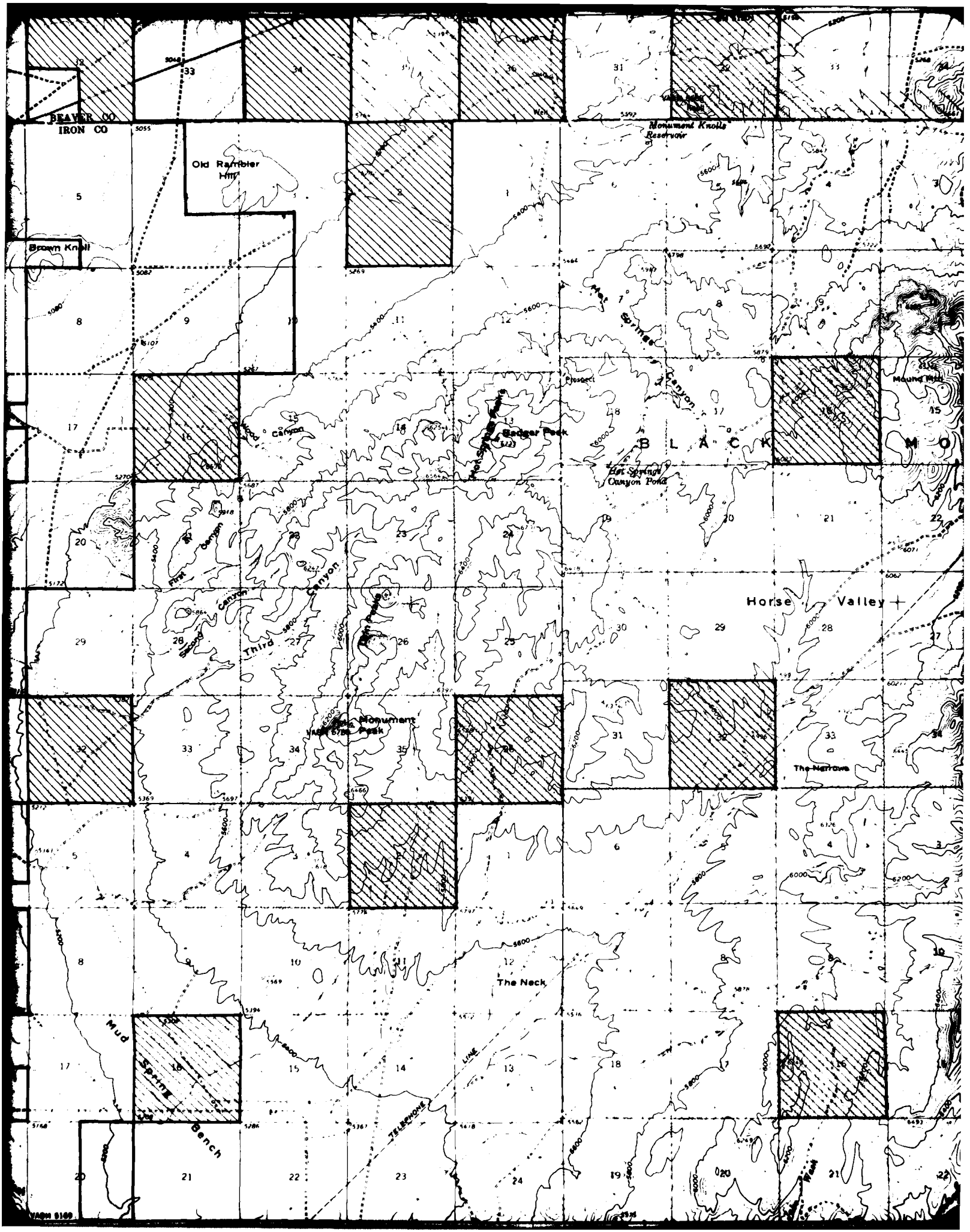
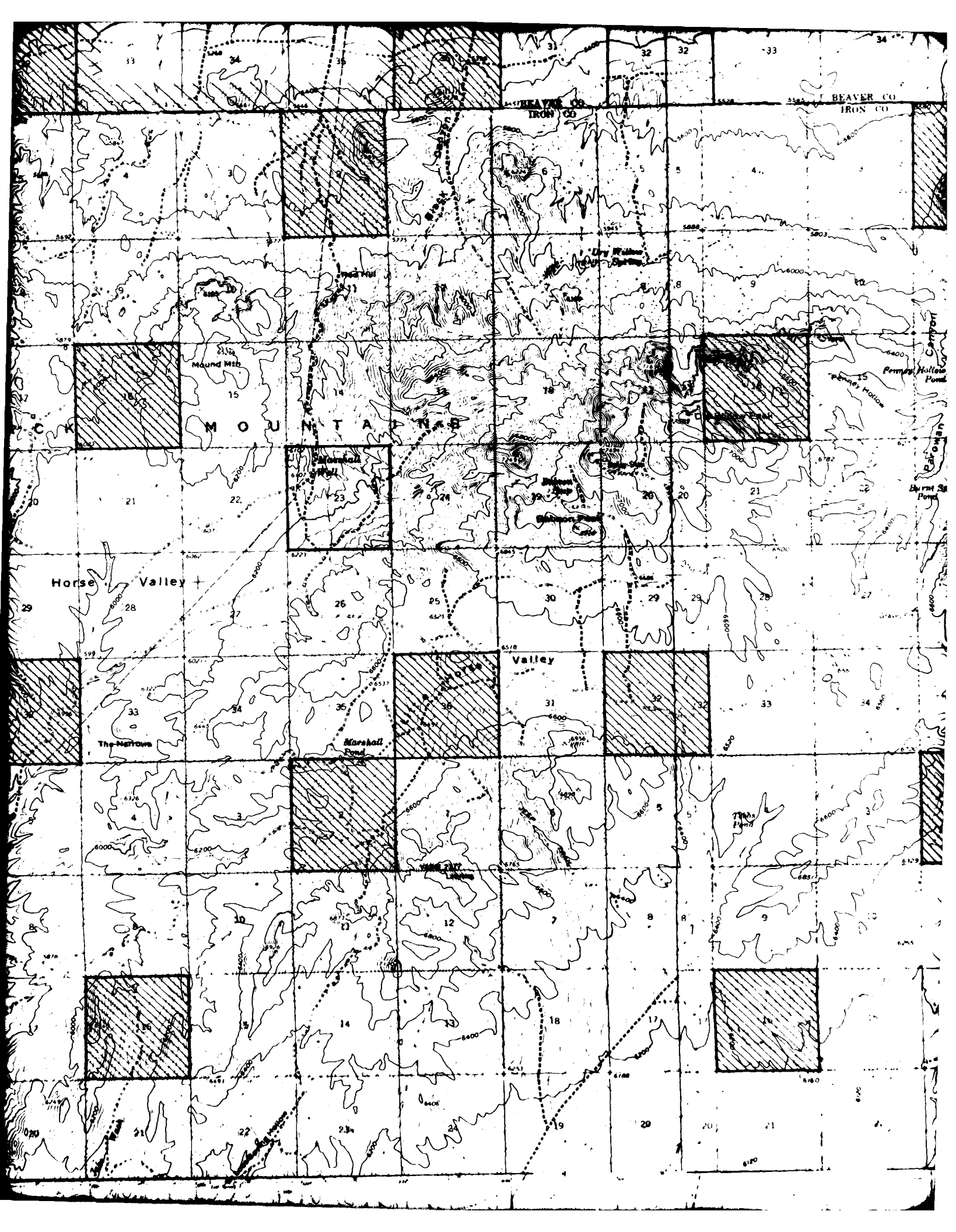
T 32 S

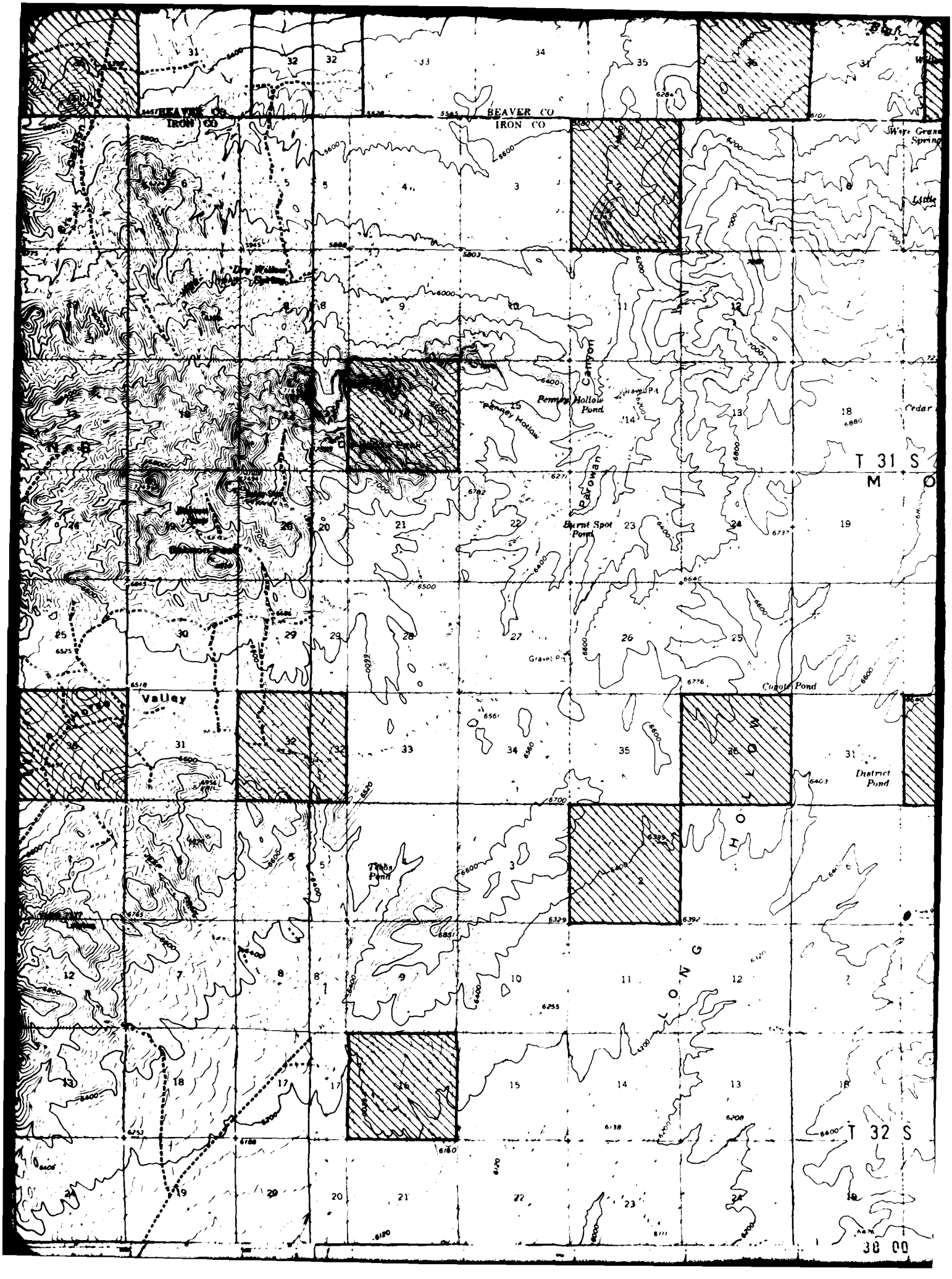

WAH WAH
MOUNTAINS
WAH WAH MOUNTAINS


DESERT


BEAVER CO
IRON CO
Old Rambler Hill
Brown Knoll
Blue Knoll
Well
First Canyon
Second Canyon
Third Canyon
Mud Spring Bench
Mud Spring Well
E S C A L A N T E
D E S E R T


BEAVER CO
IRON CO
Old Rambler Mine
Brown Knoll
Monument Knolls Reservoir
Mud Springs Canyon
Badger Peak
Hot Springs Canyon Road
Hot Springs Canyon Pond
B L A C K M O
Mound Hill
Horse Valley
First Canyon
Second Canyon
Third Canyon
Monument Peak
The Narrows
The Neck
Mud Spring Bench
TELEPHONE LINE
Wash


BEAVER CO
IRON CO
BEAVER CO
IRON CO
Mound Mtn
Marshall Hill
Horse Valley
Valley
The Narrows
Marshall Pond
Penney Hollow Pond
Burnt Spring Pond


BEAVER CO
IRON CO
BEAVER CO
IRON CO
Dry Wilson Spring
Penney Hollow Pond
Penney Hollow
Parowan Canyon
Burnt Spot Pond
Gravel Pit
Cupola Pond
District Pond
Valley
Parowan
Trails Pond
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R 1000 E
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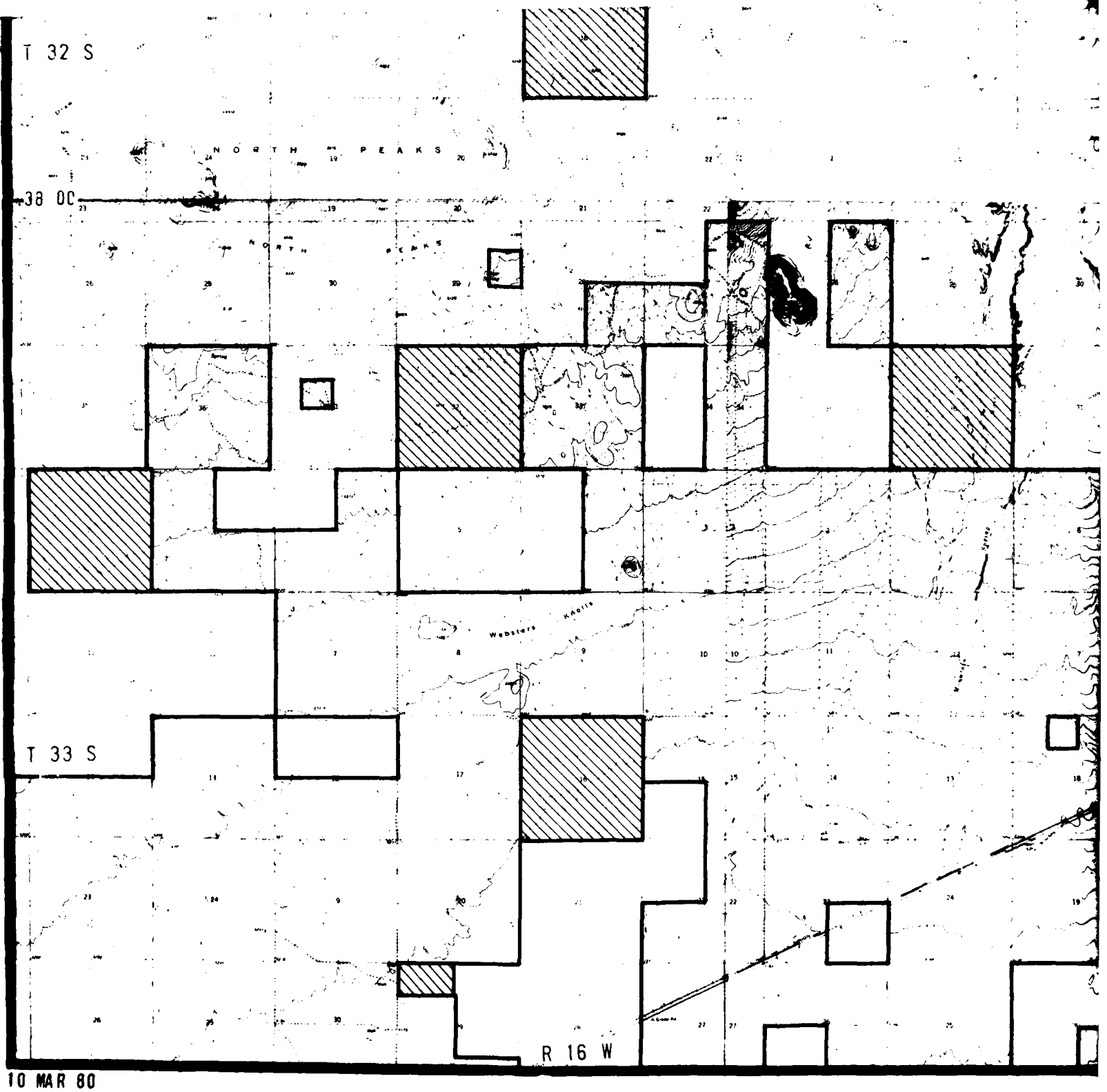

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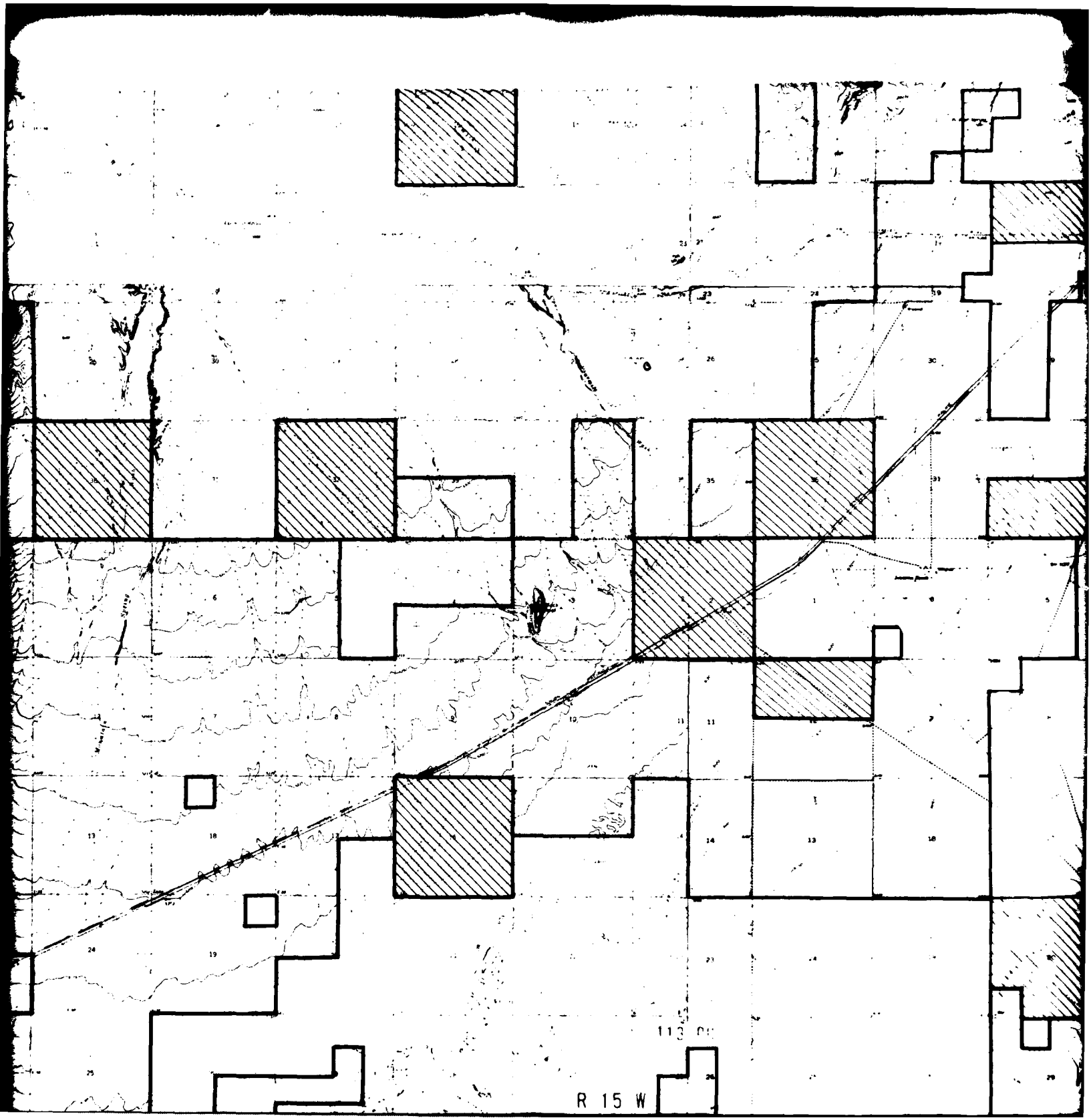
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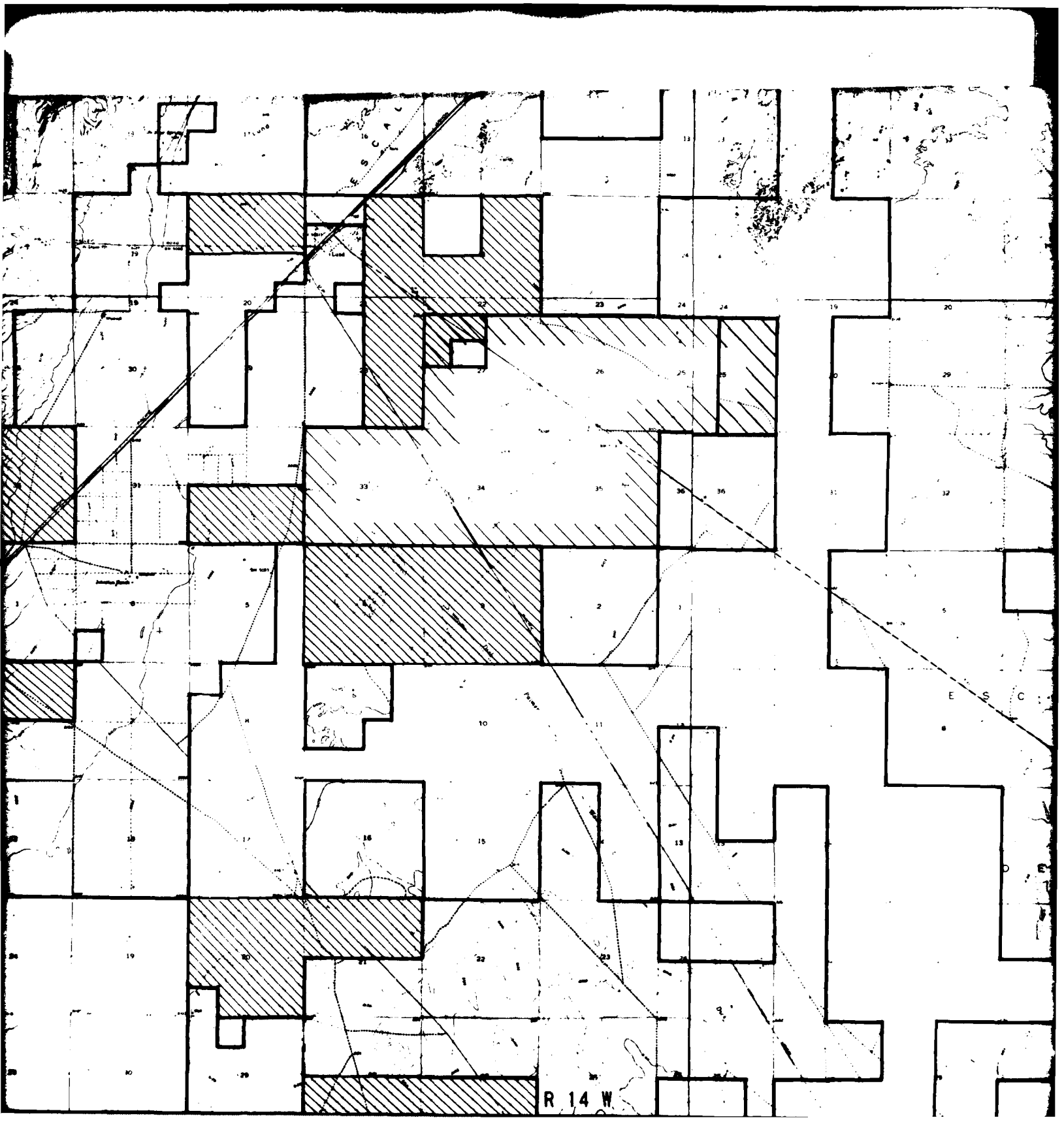
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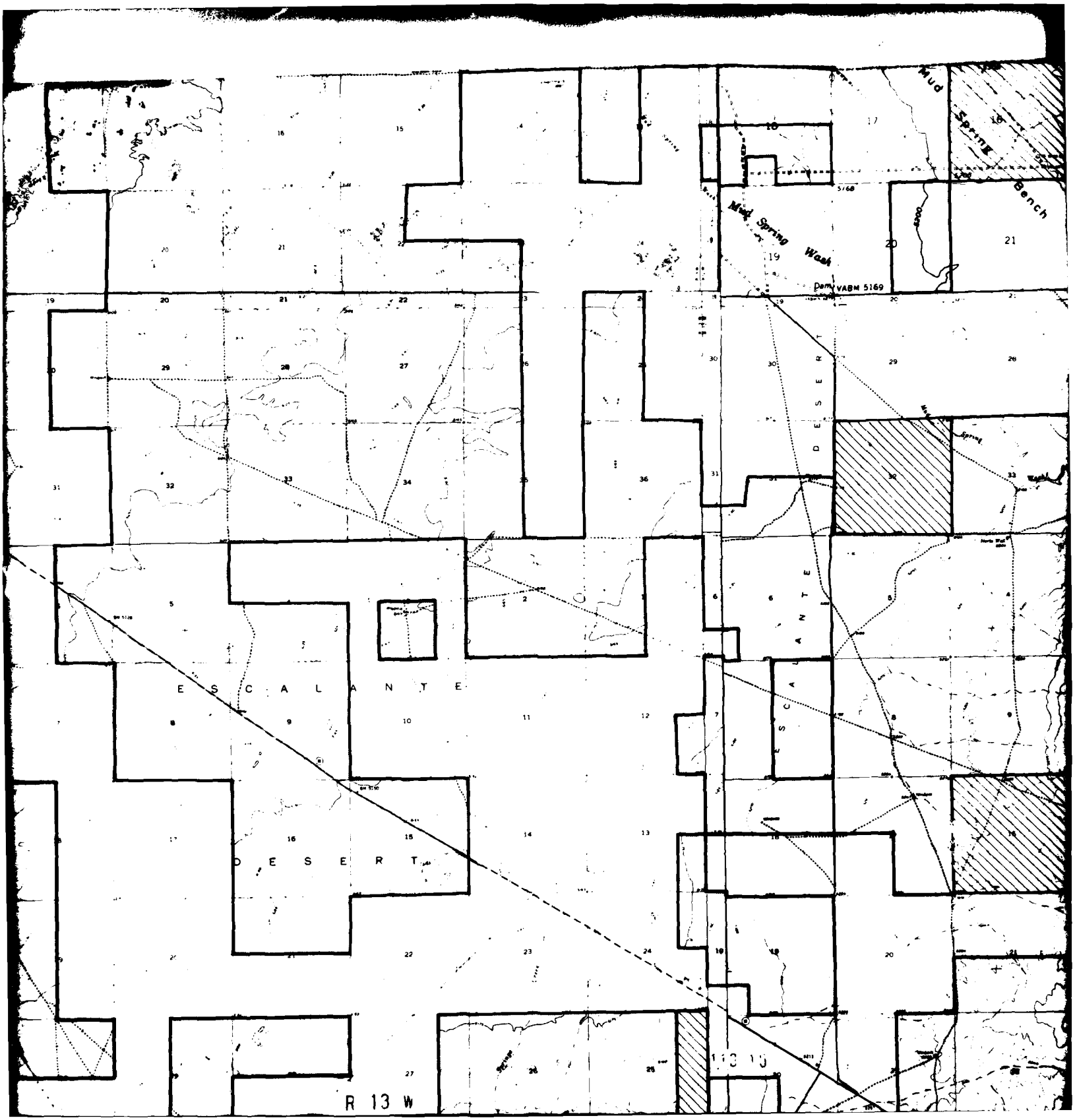
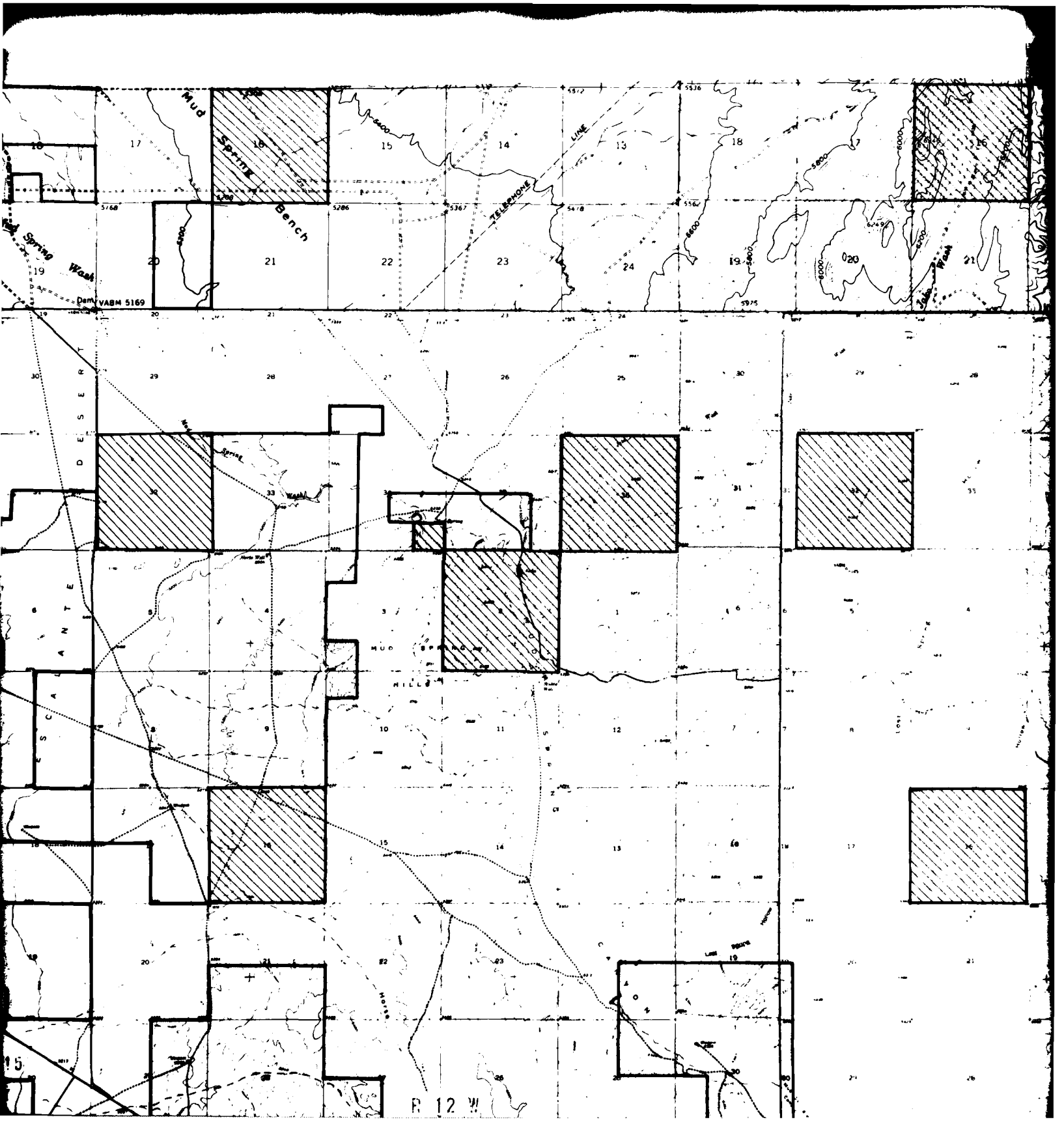
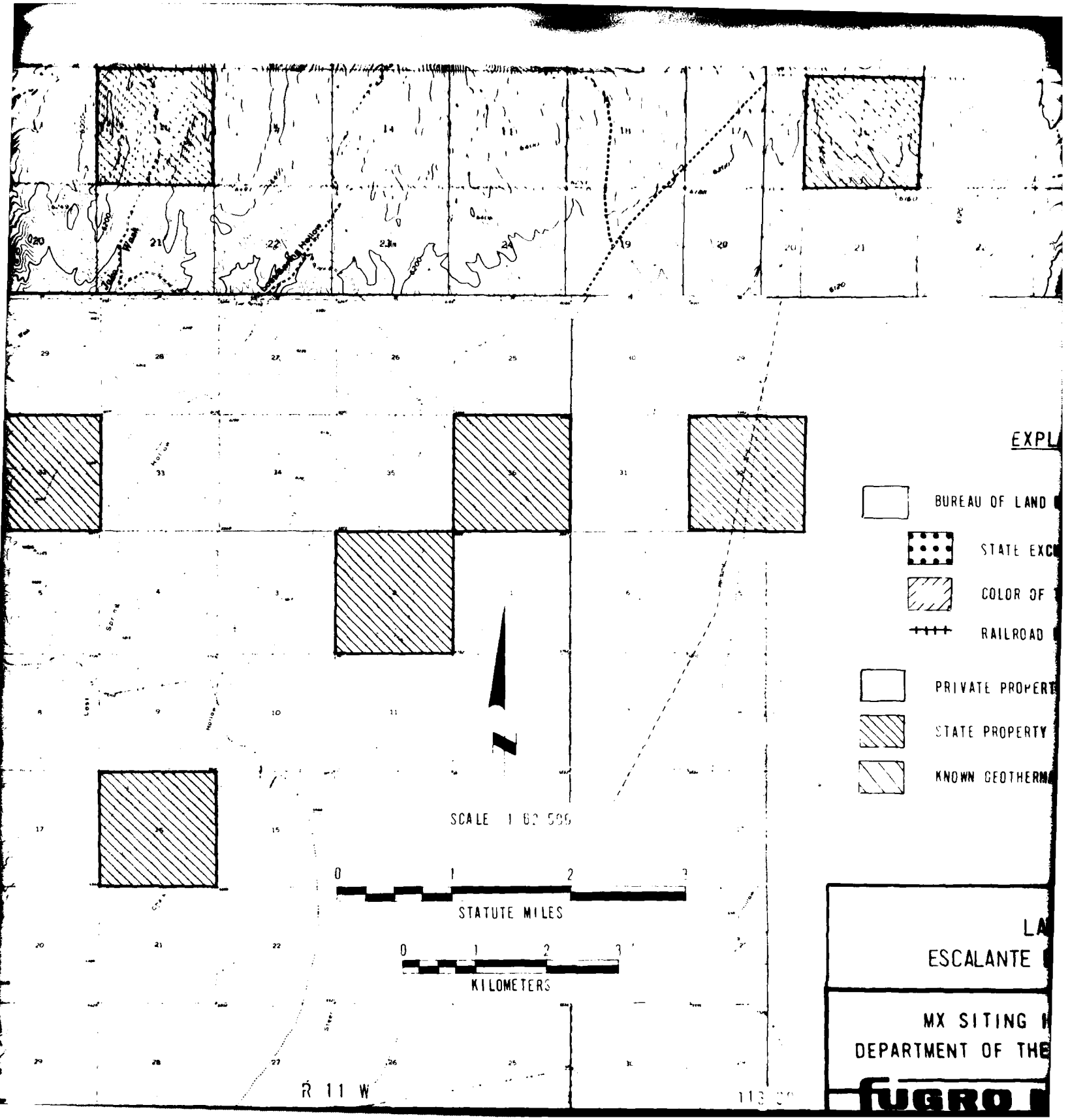
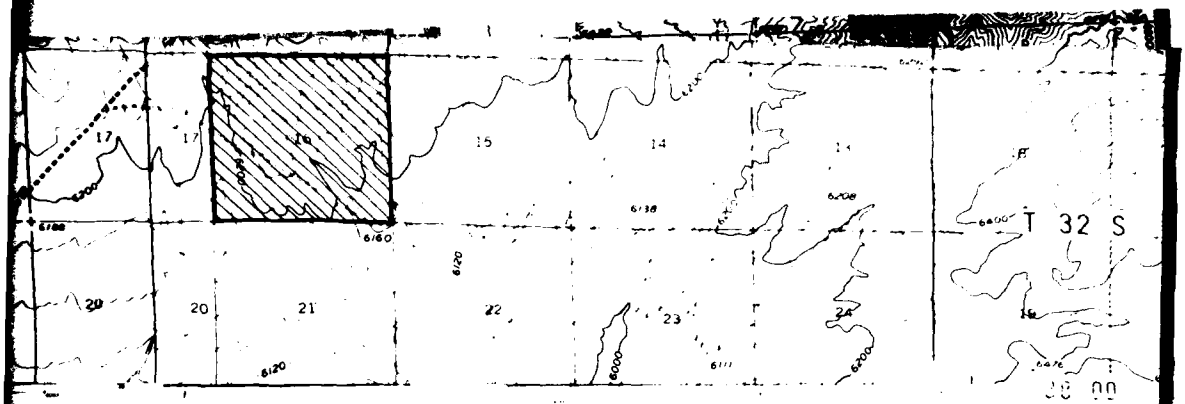

Mud Spring Bench
Mud Spring Wash
VABM 5169
ESCALANTE DESERT
ESCALANTE DESERT
R 13 W


Mud Spring Bench
Spring Wash
Dam
VABM 5169
TELEPHONE LINE
Wash
DESERET
SCAPANTE
MUD SPRING HILLS
R 12 W


EXPL
BUREAU OF LAND
STATE EXC
COLOR OF
RAILROAD
PRIVATE PROPERT
STATE PROPERTY
KNOWN GEOTHERM
SCALE 1 62 500
0 1 2 3
STATUTE MILES
0 1 2 3
KILOMETERS
R 11 W
LA
ESCALANTE
MX SITING
DEPARTMENT OF THE
FUGRO



EXPLANATION

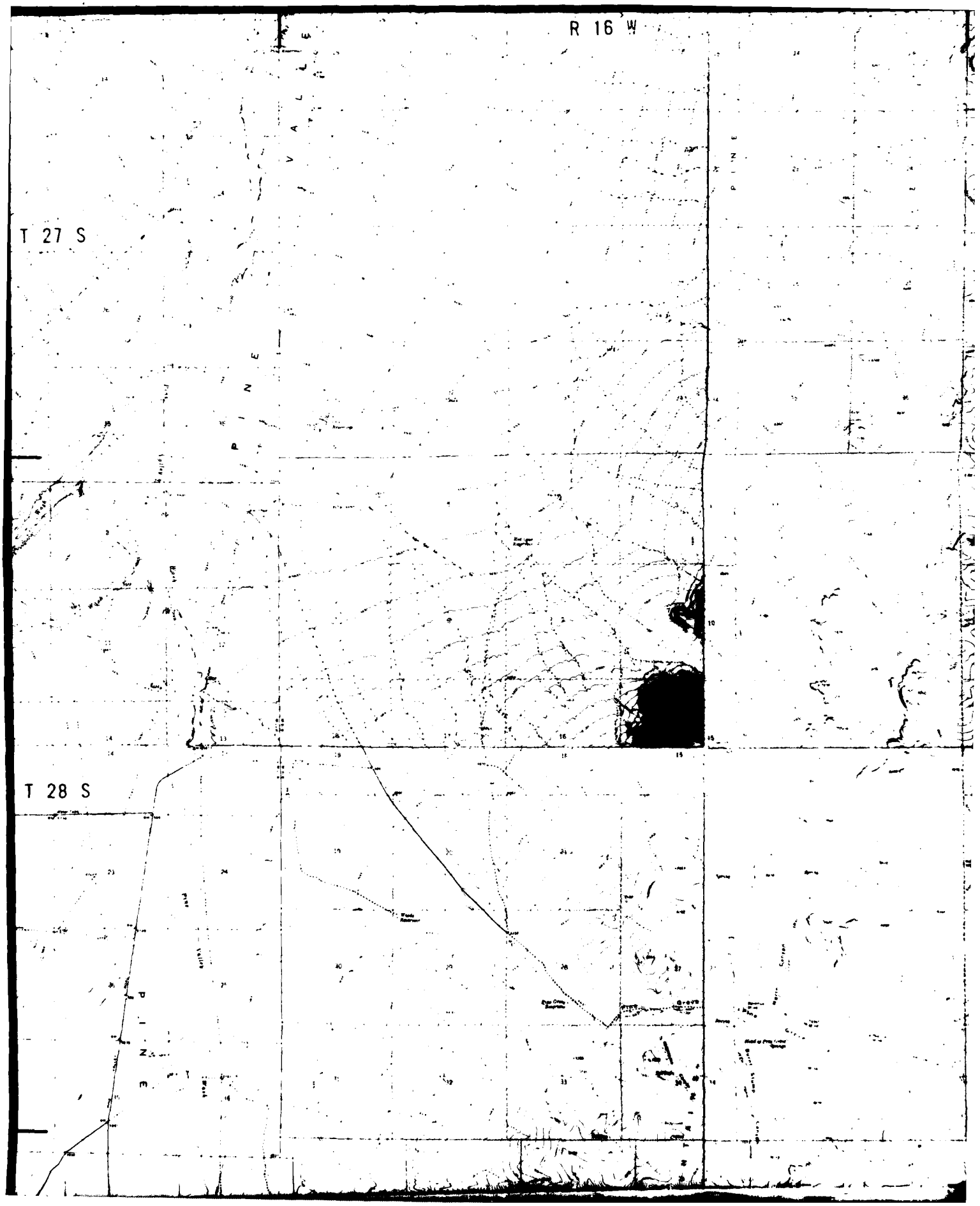
- BUREAU OF LAND MANAGEMENT (BLM)
- STATE EXCHANGE
- COLOR OF TITLE APPLICATION
- RAILROAD RIGHT OF WAY APPLICATION (ALUNITE MINE)
- PRIVATE PROPERTY INCLUDING MINING PATENTS
- STATE PROPERTY INCLUDING MATERIAL SITES
- KNOWN GEOTHERMAL RESOURCE AREA

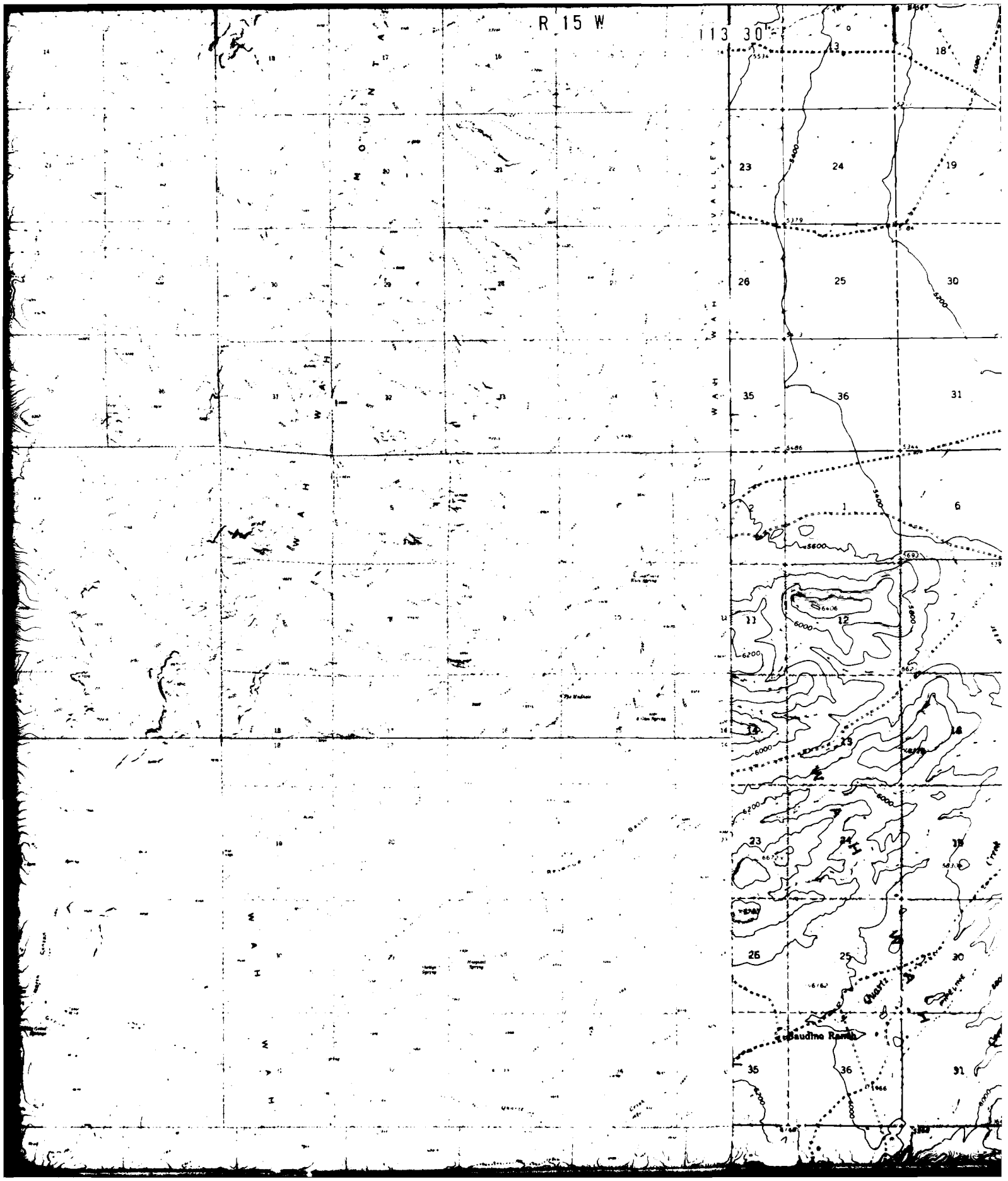
LAND STATUS MAP
ESCALANTE DESERT, MILFORD AREA, UTAH

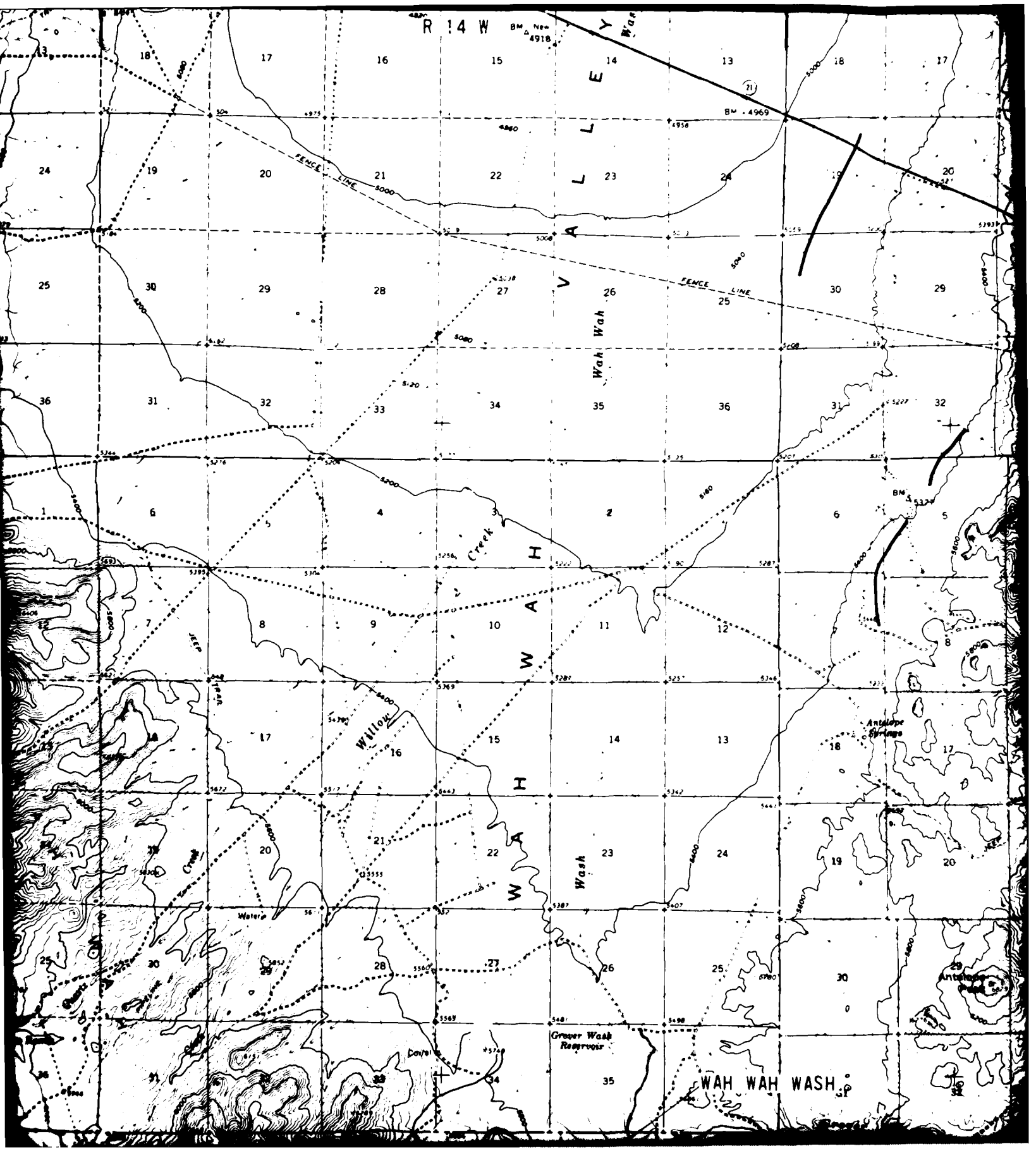
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

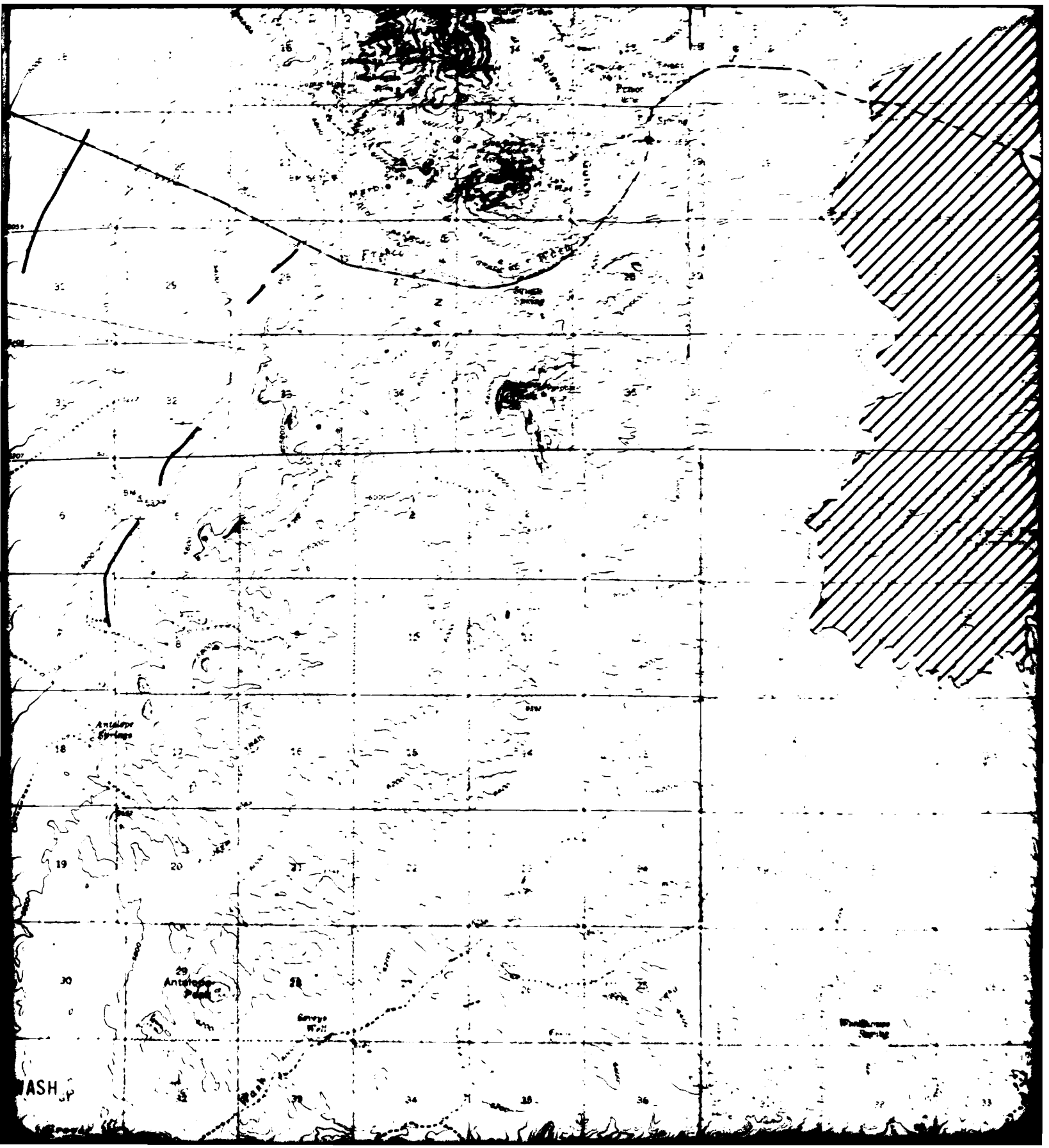
DRAWING
4-1

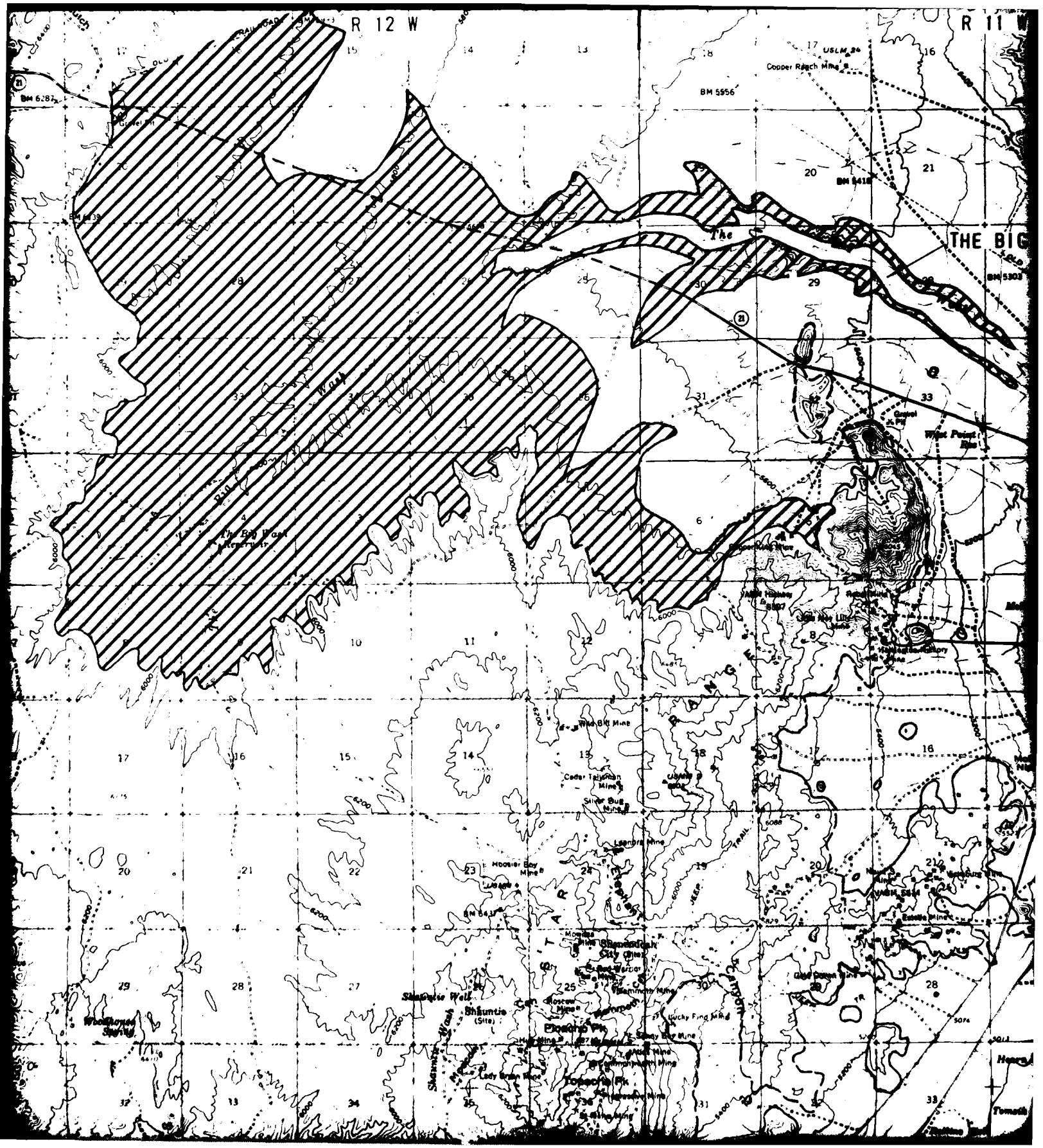
FUGRO NATIONAL, INC.


R 16 W
T 27 S
T 28 S
PINE VALLEY
PINE


R 15 W
113 30'
WASHINGTON
WASHINGTON
VALLEY
Quartz
Claudine Ranch


R 14 W
BM △ New 4918
BM ▪ 4969
FENCE LINE
FENCE LINE
Wah Wah Valley Wash
Creek
Willow
Wash
Antelope Springs
Grover Wash Reservoir
WAH WAH WASH
JEEP TRAIL


Antelope Springs
Antelope Peak
Savage Well
WASH


R 12 W
R 11 W
THE BIG
Copper Reach Mine
BM 5956
BM 6287
BM 5303
Gravel Pit
Wood
Lake
Shaumtie Well
Shaumtie
(Site)
Shaumtie Wash
Shaumtie Canyon
Topaz Mtn
Topaz Pk
Lucky Find Mine
Lady Brian Mine
Hoosier Boy Mine
Silver Bug Mine
Wild Bill Mine
Cedar Talisman Mine
Leonora Mine
Eleanor
Eleanor Pk
Sheepshead
Sheepshead City Claim
Mammoth Mine
Mammoth-Topaz Mine
Sunset Mine
Sunset Mine No. 2
Sunset No. 2 Mine
Sunset No. 3 Mine
Sunset No. 4 Mine
Sunset No. 5 Mine
Sunset No. 6 Mine
Sunset No. 7 Mine
Sunset No. 8 Mine
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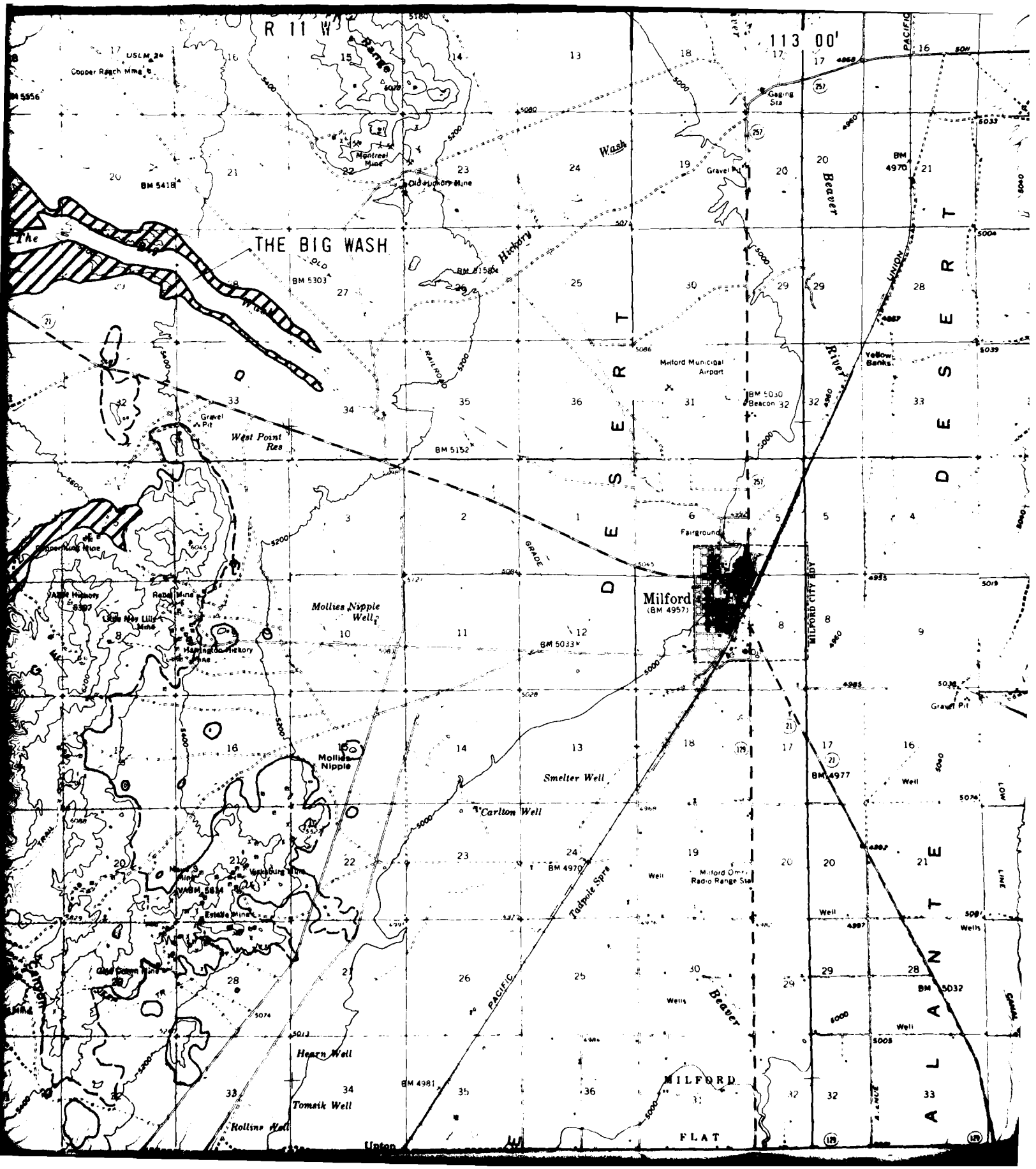
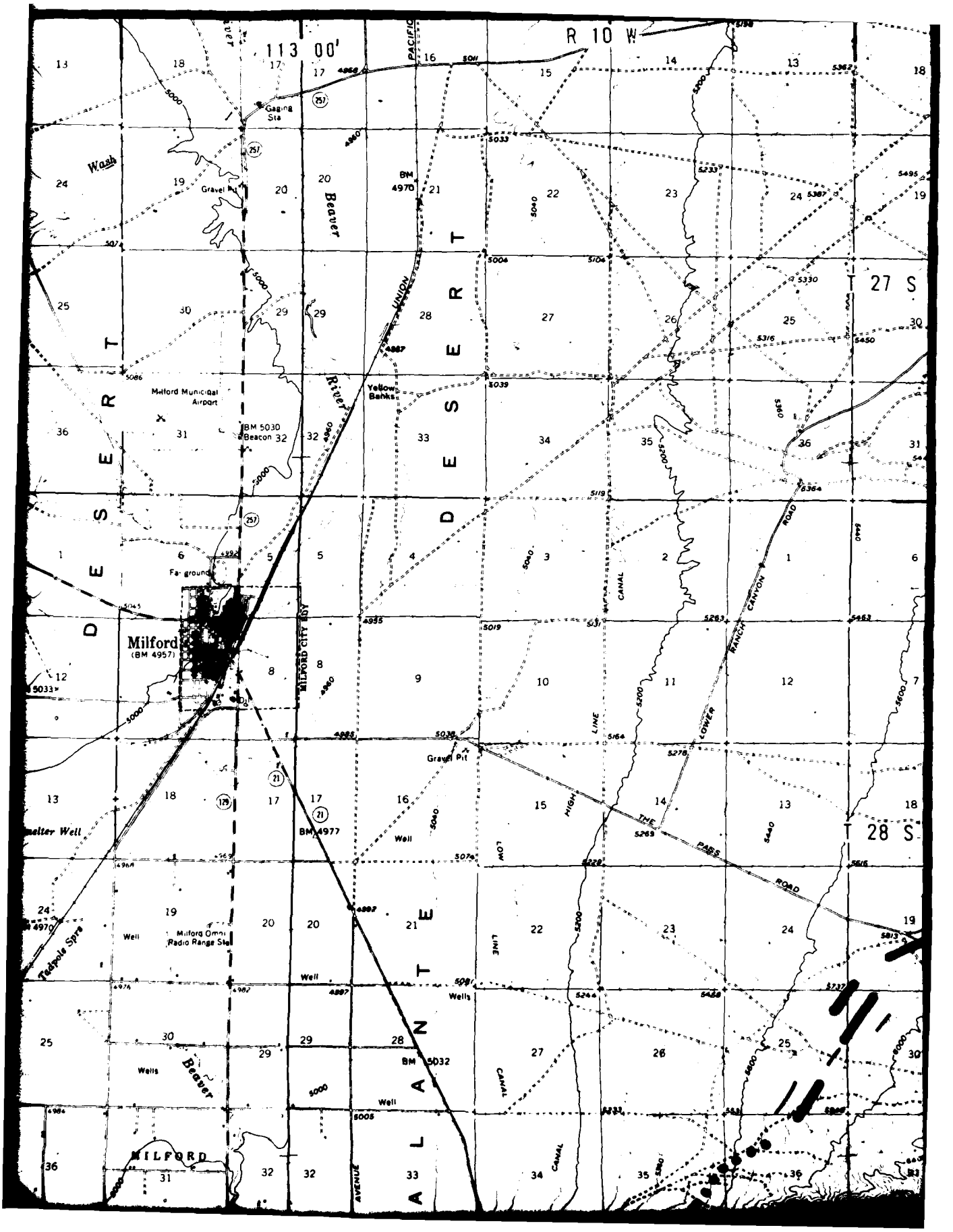
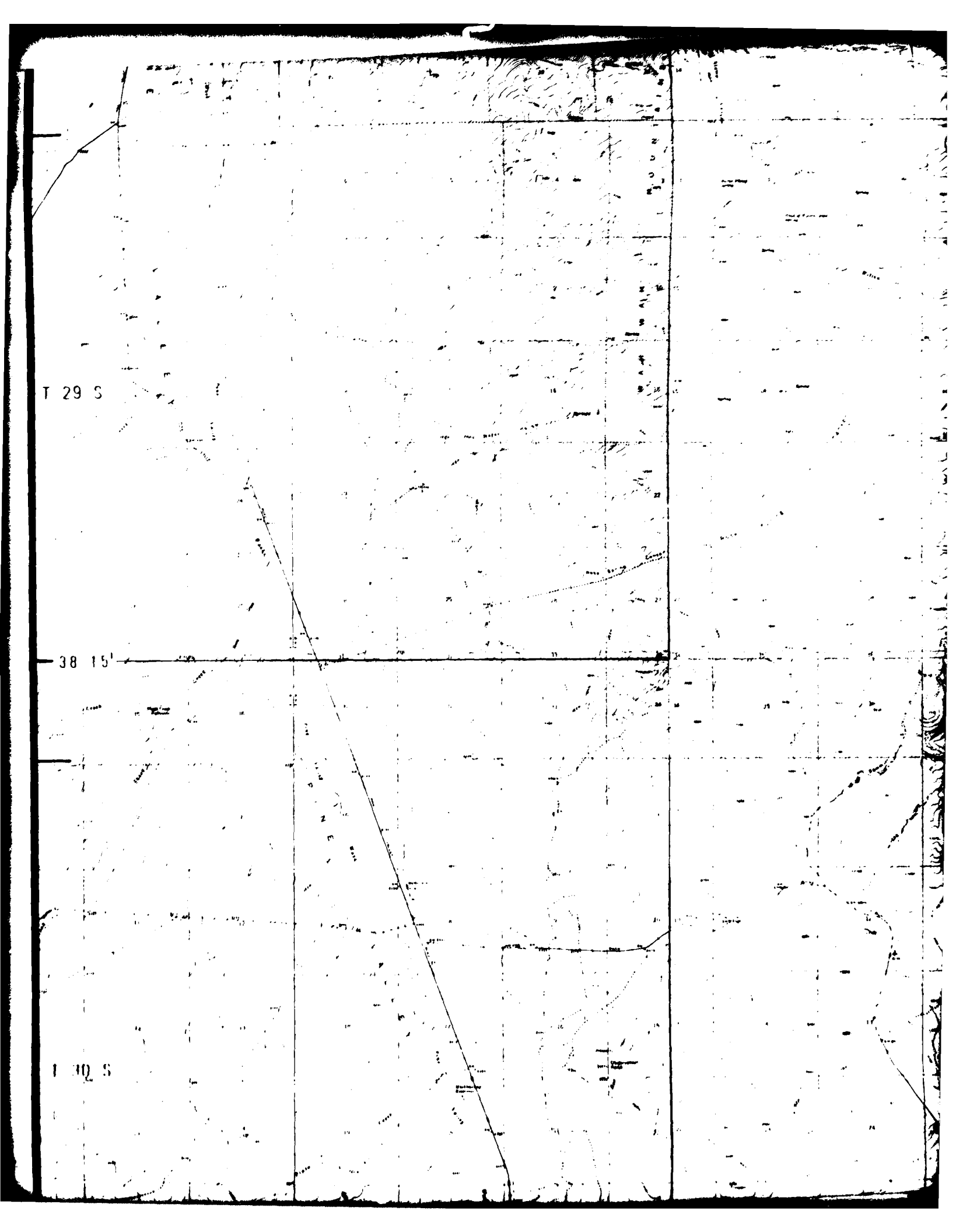
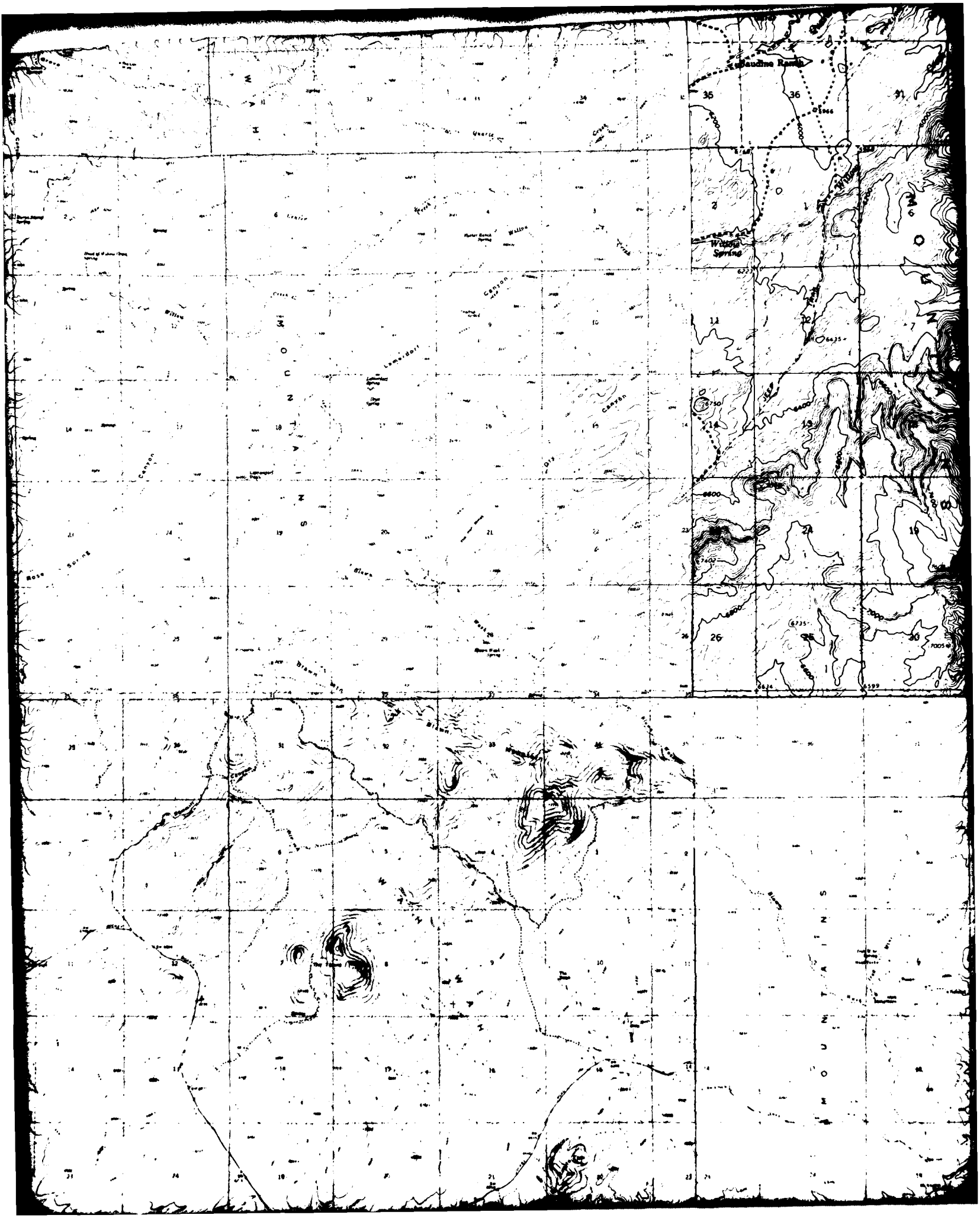
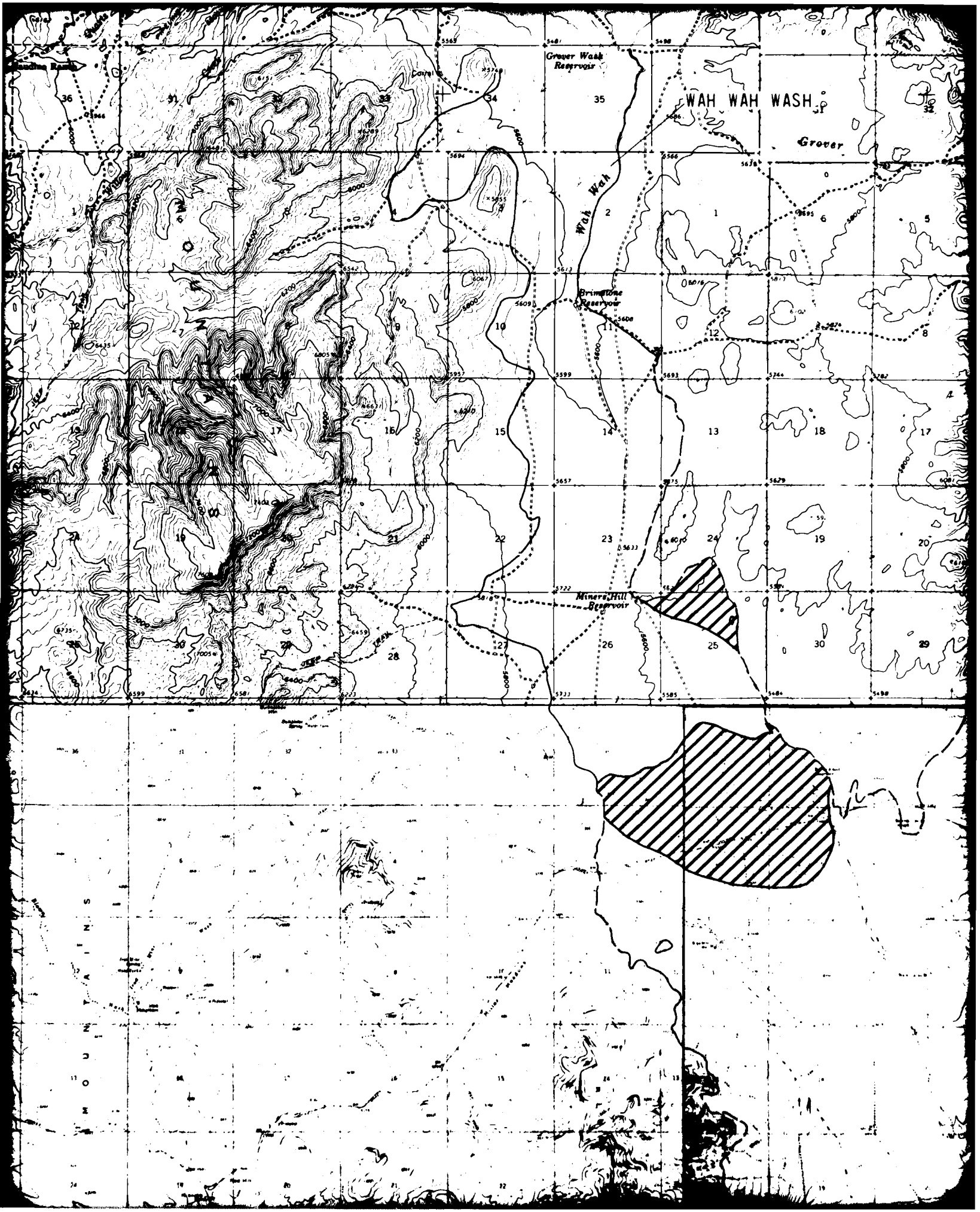
Sunset No. 99 Mine
Sunset No. 100 Mine

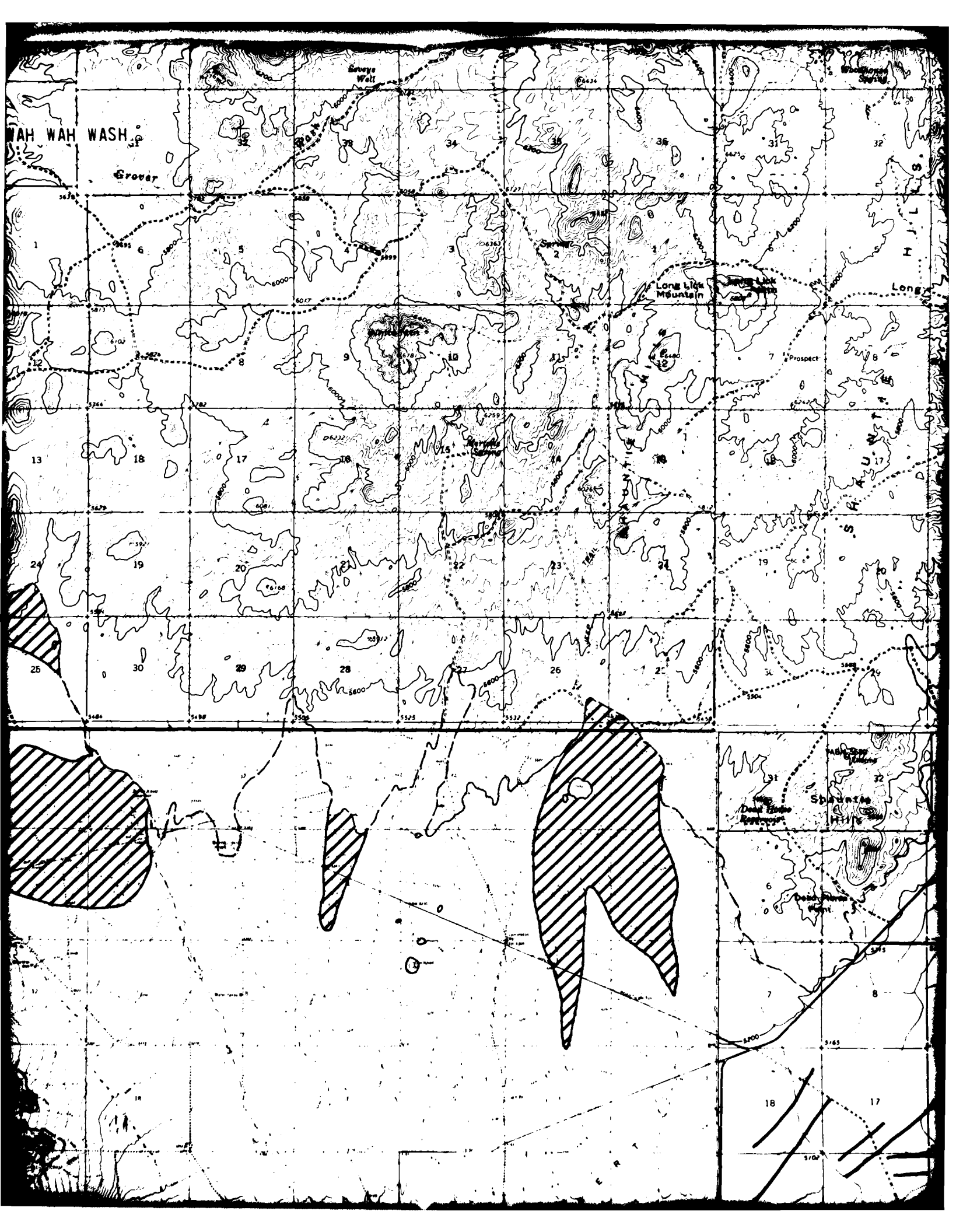

R 11 W
113 00'
THE BIG WASH
DESERT
DESERT
ALLANTE
Milford
(BM 4957)
Milford Municipal Airport
Milford Omni Radio Range Sta
MILFORD FLAT
Fairground
Gaging Sta
Gravel Pit
Gravel Pit
Beacon
Wash
Beaver
Beaver
Hickory
West Point Res
Mollies Nipple Well
Mollies Nipple
Smelter Well
Carlton Well
Tadpole Spr
Hearn Well
Tomaik Well
Rollins Well
Montreal Mine
Old Hickory Mine
Copper Ranch Mine
Rebel Mine
Little Ray Lily Mine
Harrington-Hickory Mine
Estella Mine
Old Camp Mine
Yellow Banks
Milford City Boy
Upton
Well
Wells
BM 5418
BM 5303
BM 5158
BM 5152
BM 5030
BM 5033
BM 4970
BM 4977
BM 4981
BM 5032
RAILROAD
PACIFIC
UNION
PACIFIC
TRAIL
LINE
LOW

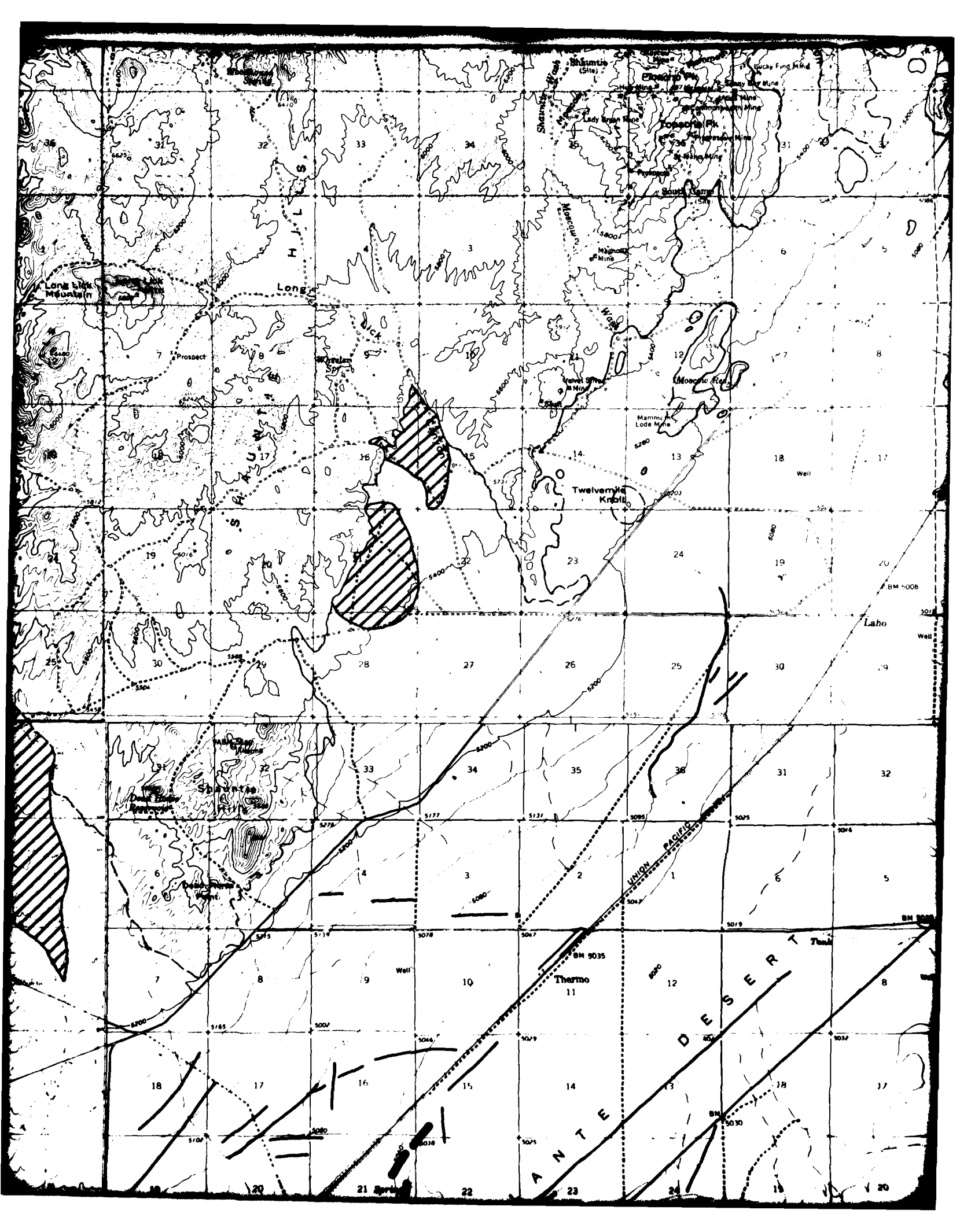

113 00'
R 10 W
T 27 S
T 28 S
Gaging Sta
Gravel Pit
Wash
Beaver
BM 4970
Milford Municipal Airport
BM 5030
Beacon
Yellow Banks
River
DESERT
Fa grounds
Milford
(BM 4957)
MILFORD CITY HWY
UNION PACIFIC
CANAL
RANCH CANYON ROAD
LOWER
HIGH
THE PASS
ROAD
LINE
Gravel Pit
BM 4977
Well
melter Well
Tadpole Spra
Milford Omni Radio Range Sta
Wells
BM 5032
ALTA
MILFORD
AVENUE

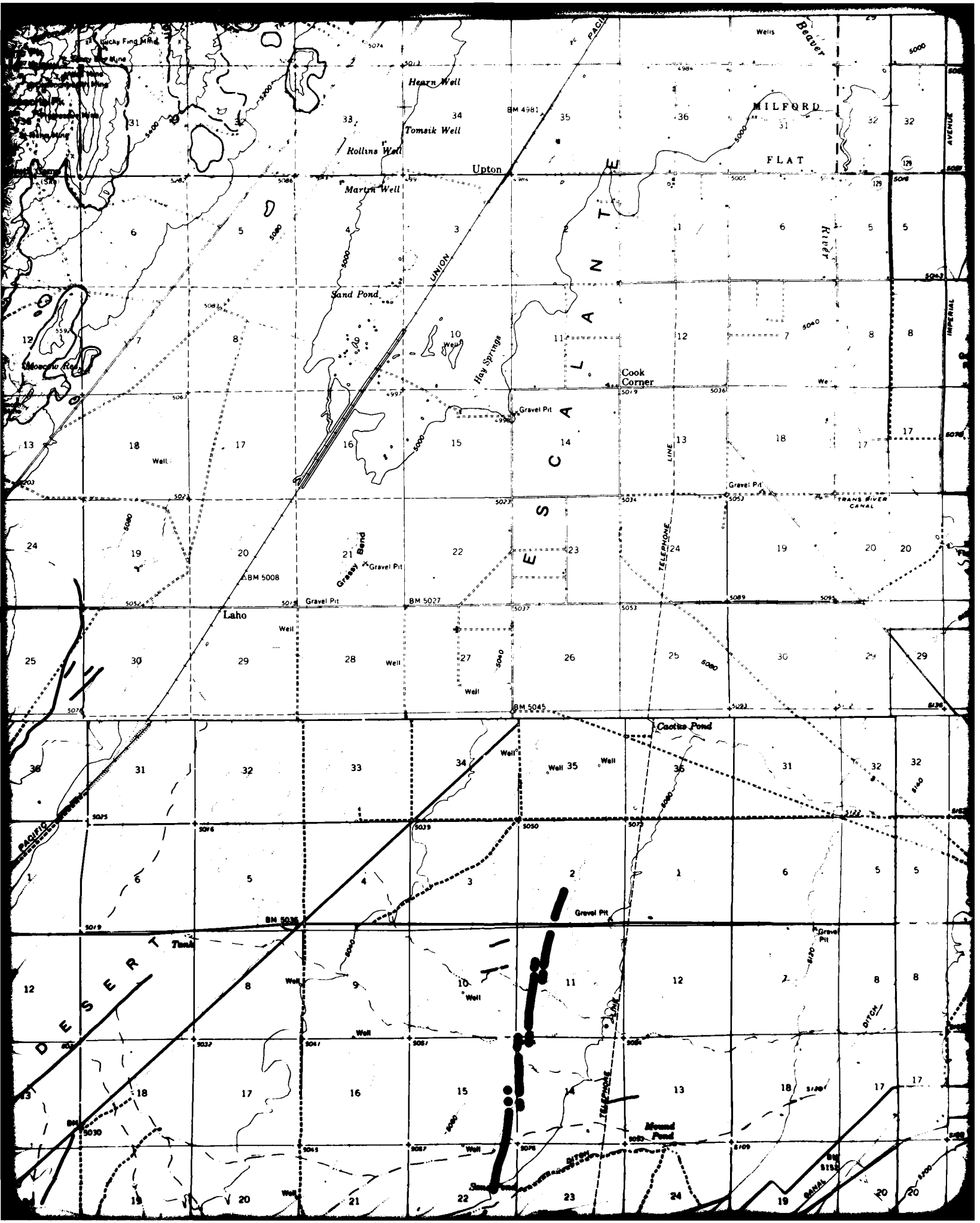

T 29 S
38 15'
T 30 S

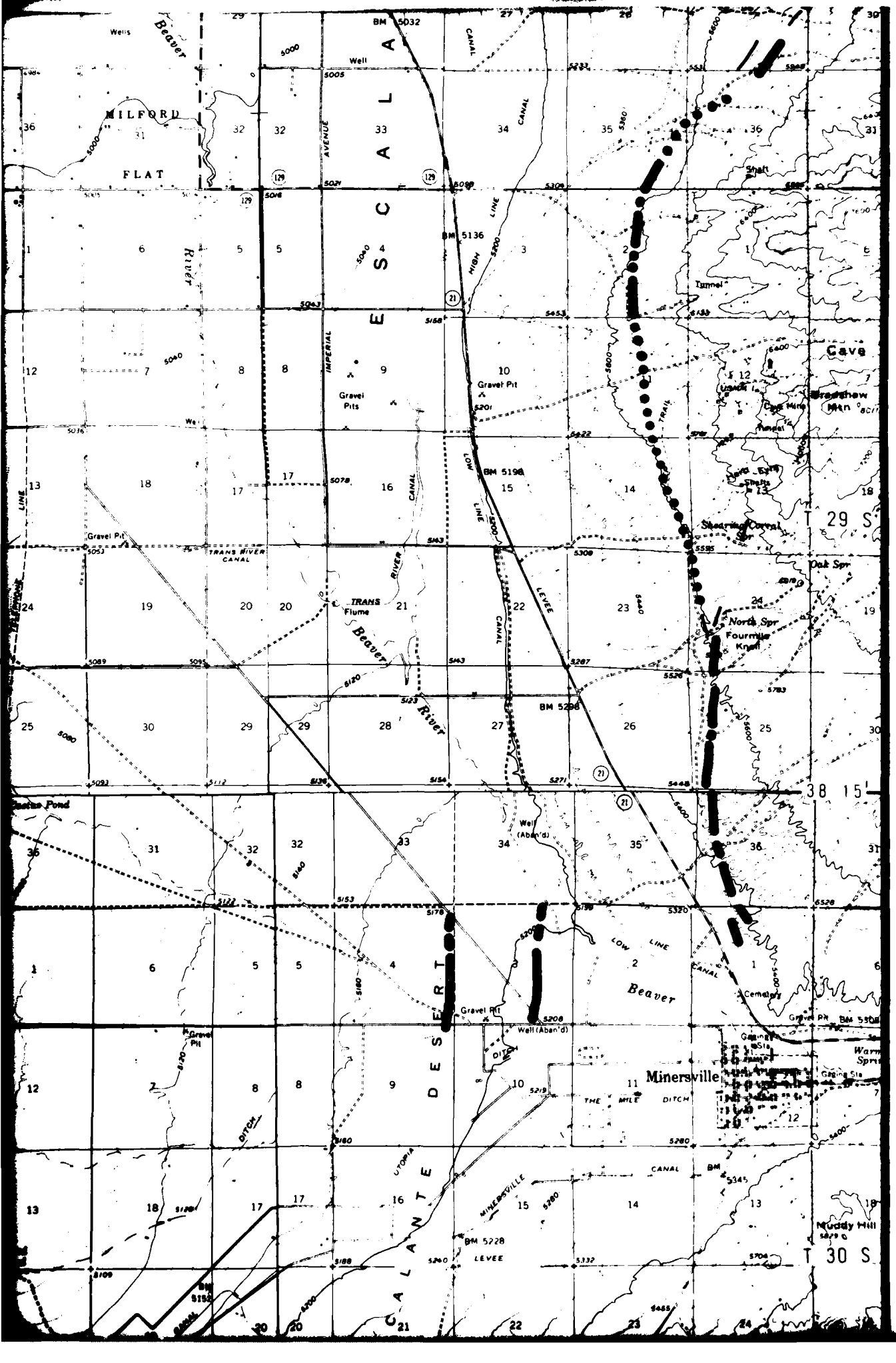

Claudine Ranch
Wilkins Spring

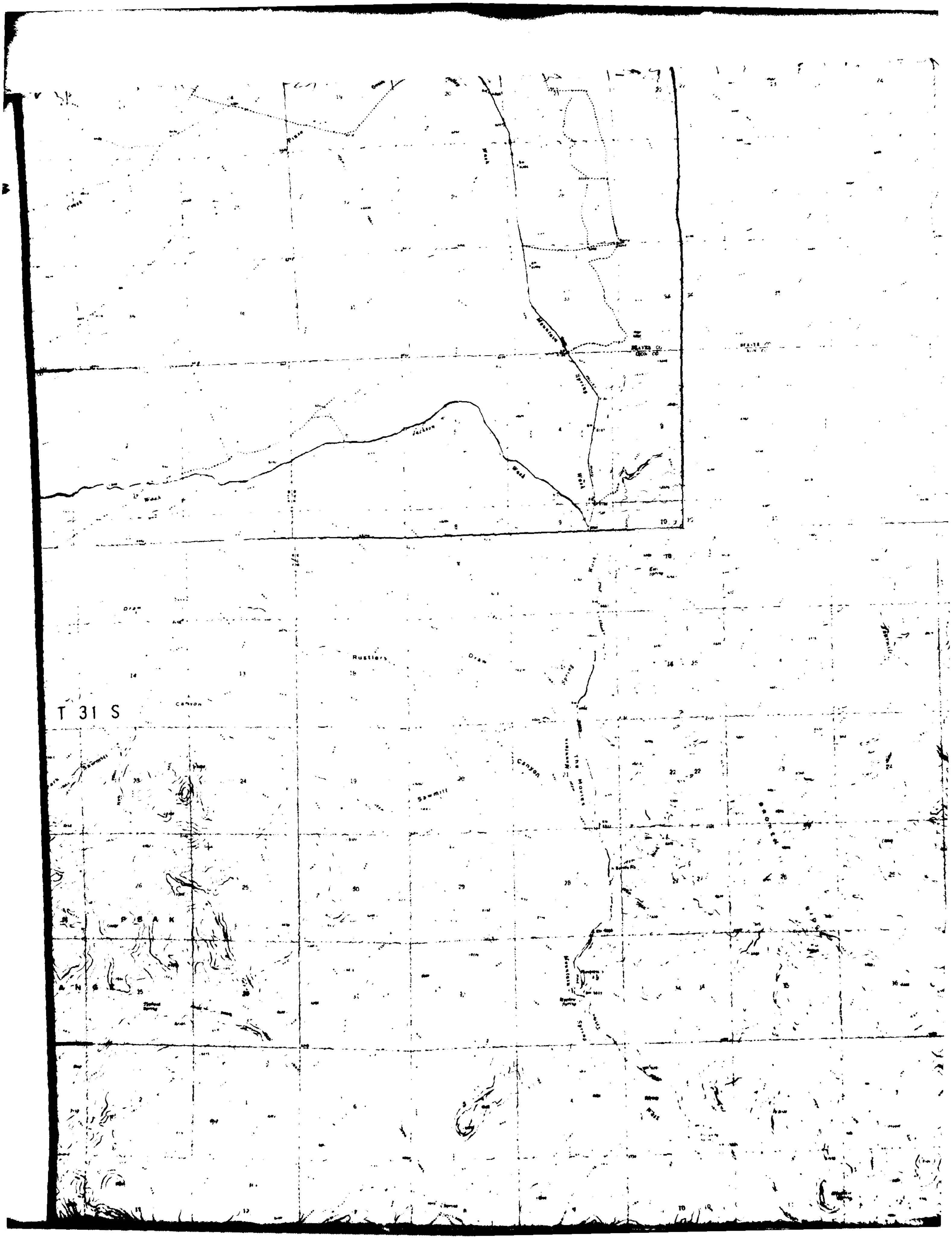

WAH WAH WASH
Grover Wash Reservoir
Grover
Wah Wah
Brimstone Reservoir
Miners Hill Reservoir


WAH WAH WASH
Grover
Long Lick Mountain
Prospect
Shaventa Hills

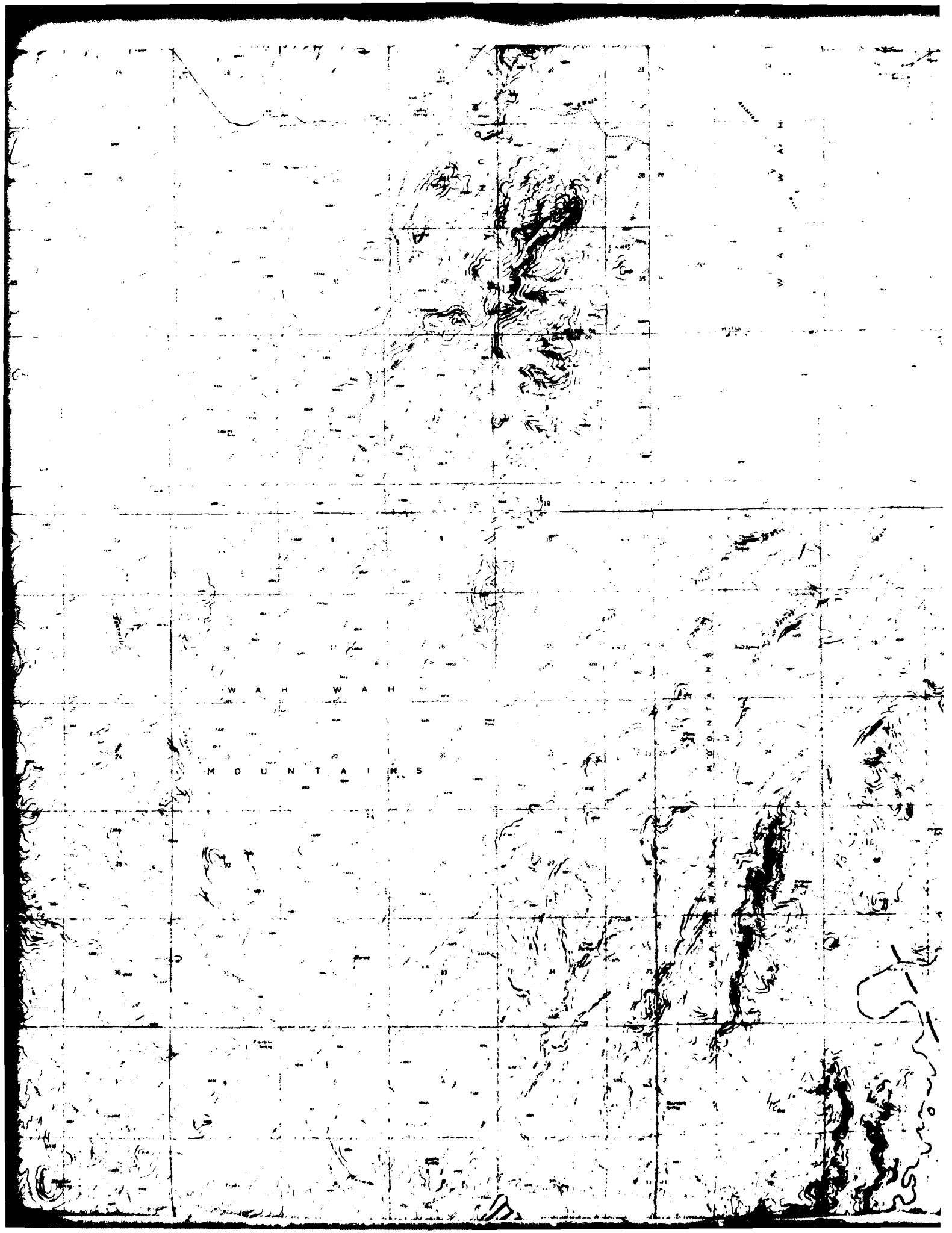

Bonanza Spring
Shamrock Wash
Lady Brian Mine
Topsoria Pk
Bonanza King Mine
Lucky Find Mine
Mammoth Mine
Moscow Wash
Long Dick Wash
Long Dick Hills
Long Dick Mountain
Prospect
Wheeler Spr.
Travel Spring Mine
Moscow Road
Mammoth Lode Mine
Twelvemile Knolls
Well
BM 5008
Laho
Shoshonite Hill
Desert Home Reservoir
Desert Home Wash
UNION PACIFIC
BM 5035
Thermo
Tank
BM 5030
ANTELOPE DESERT


Hearn Well
Tomsik Well
Rollins Well
Martin Well
Upton
MILFORD
FLAT
Sand Pond
Hay Springs
Cook Corner
Gravel Pit
Laho
Well
Grassy Bend
BM 5008
BM 5027
BM 5045
Cactus Pond
BM 5035
Tank
DESERT
Mound Pond
Ditch
Canal
Beaver
River
Imperial
Avenue
Telephone
Line
Trans River Canal
Pacific


MILFORD
FLAT
SCALA
DESERT
CALANTE
Beaver
Beaver River
Wells
Well
Gravel Pit
Gravel Pits
Tunnel
Cave
Shearing Corral
Oak Spr
North Spr
Fourmile Knoll
Flume
TRANS
TRANS RIVER CANAL
IMPERIAL AVENUE CANAL
HIGH LINE CANAL
LOW LINE CANAL
LEVEE
TRAIL
DITCH
THE MILE DITCH
Cemetery
Minersville
Muddy Hill
Warm Spr
BM 5032
BM 5136
BM 5198
BM 5296
BM 5228
BM 5345
T 29 S
T 30 S

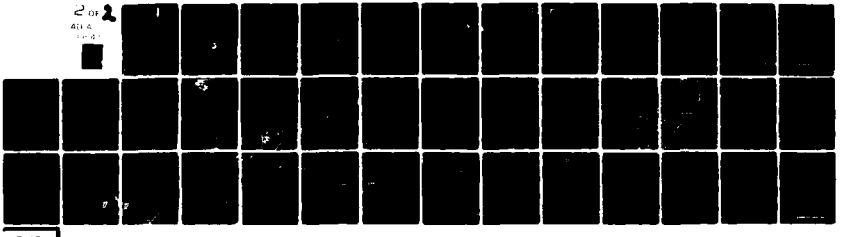


T 31 S
Rustlers
Draw
Canyon
Sawmill
Jackson
Wash
Spring


WAH WAH
MOUNTAINS

AD-A112 411 FUGRO NATIONAL INC LONG BEACH CA F/G 16/1
MX SITING INVESTIGATION. PROPOSED OPERATIONAL BASE SITE, ESCALA--ETC(U)
MAR 80 F04704-80-C-0006
UNCLASSIFIED FN-TR-35-2 NL

2 OF 2
AD A112 411



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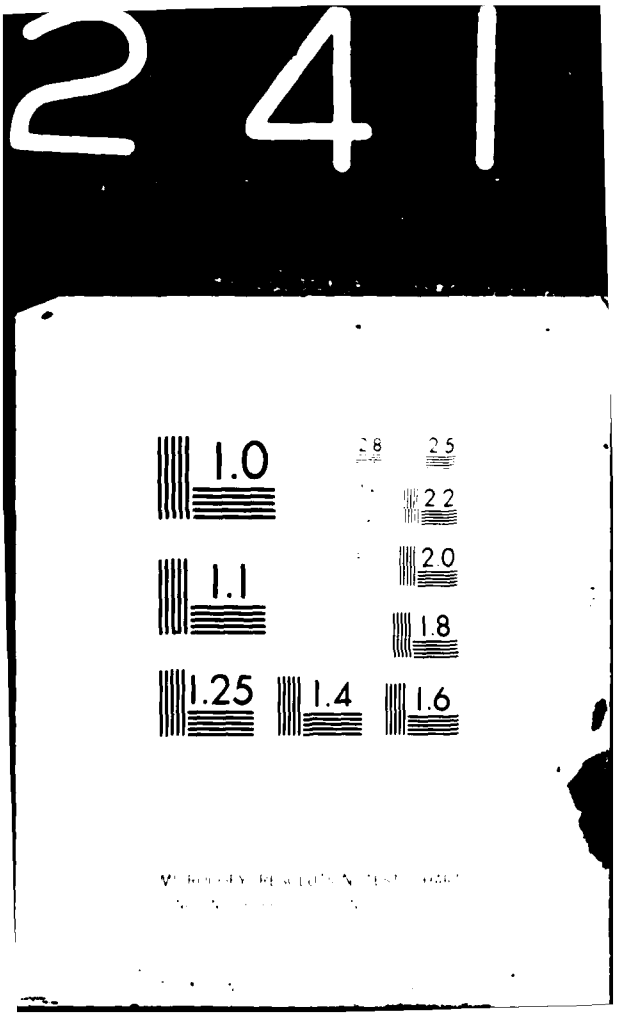
241
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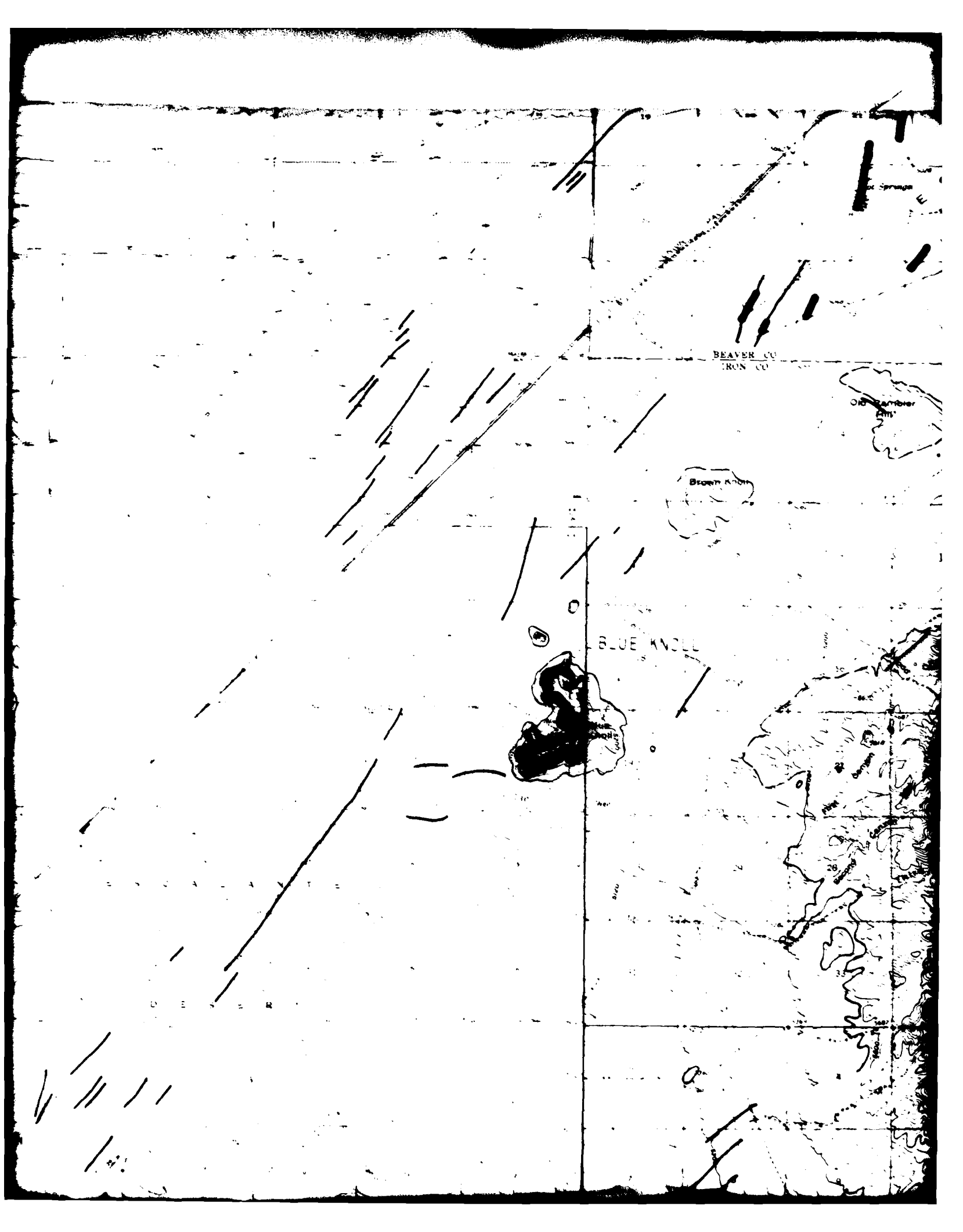
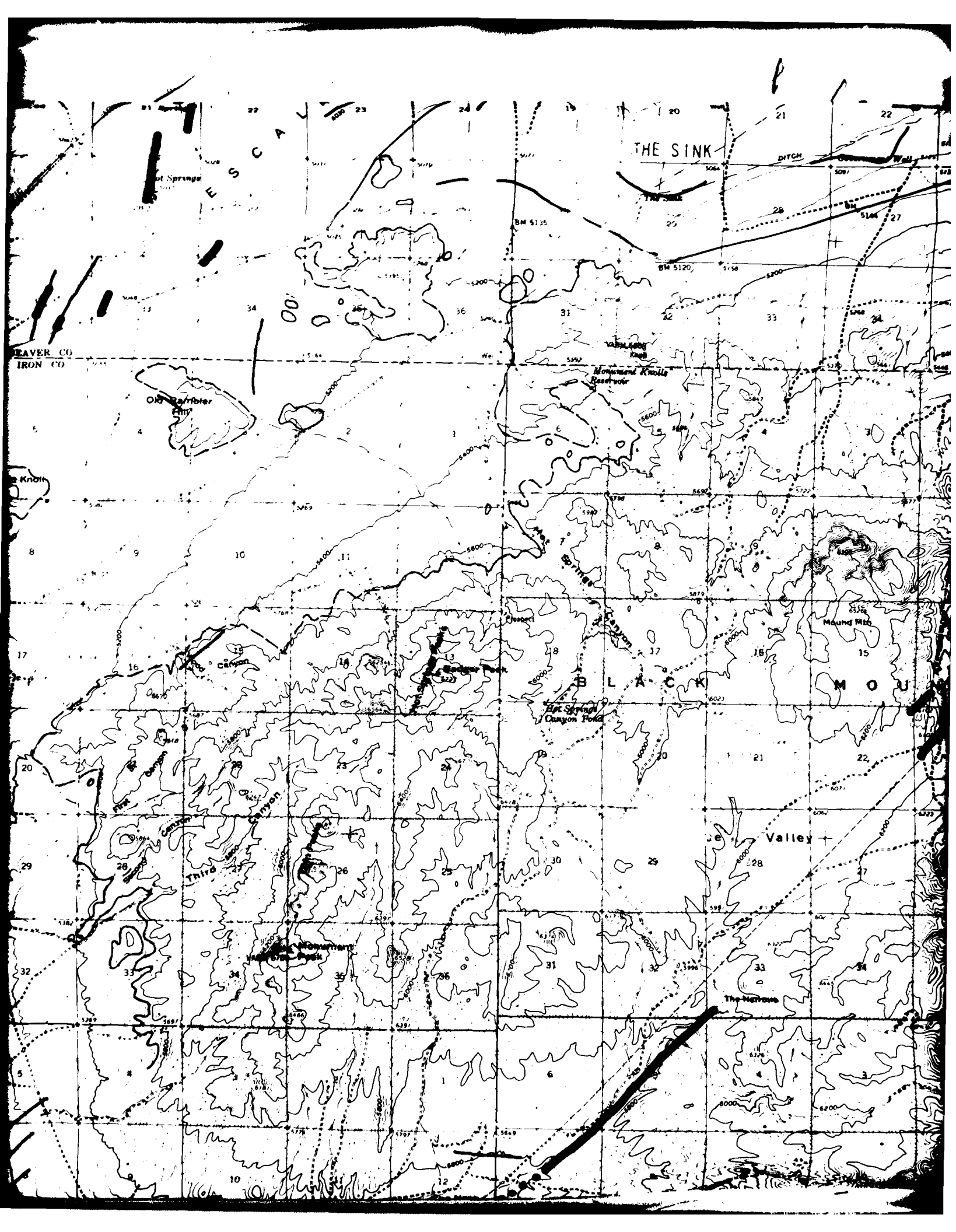
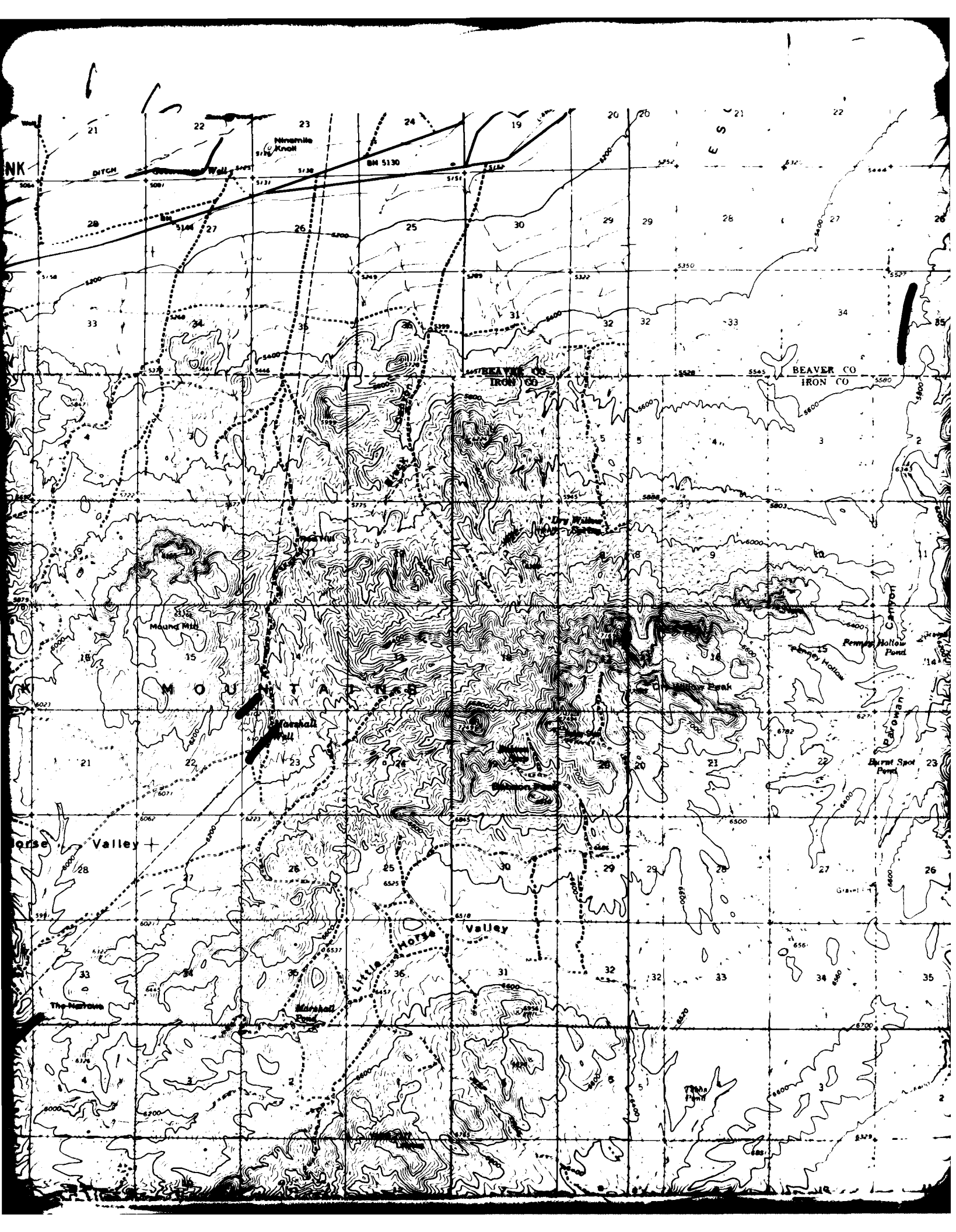
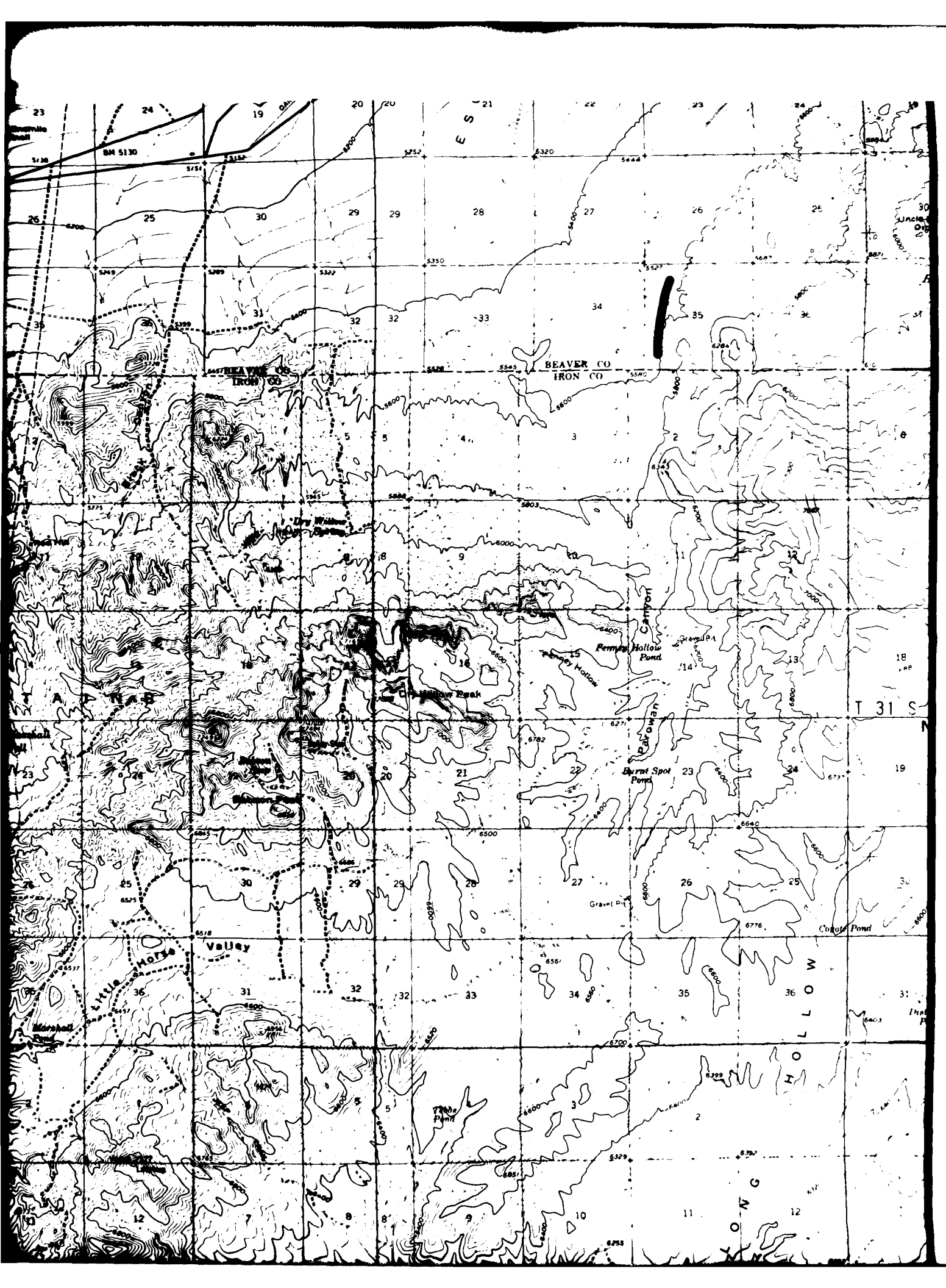
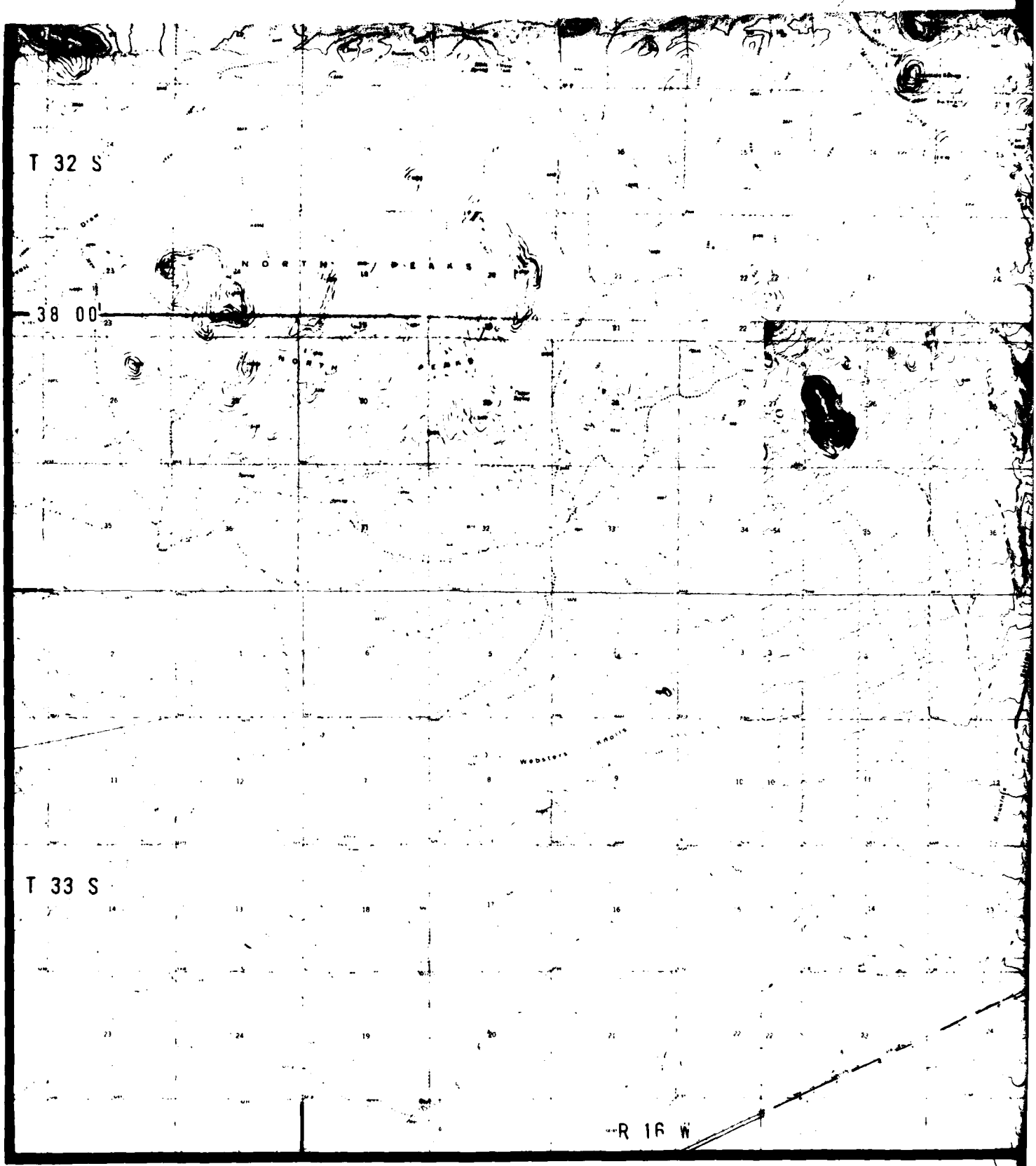
LUND FLATS


BEAVER CO
IRON CO
BLUE KNOLL

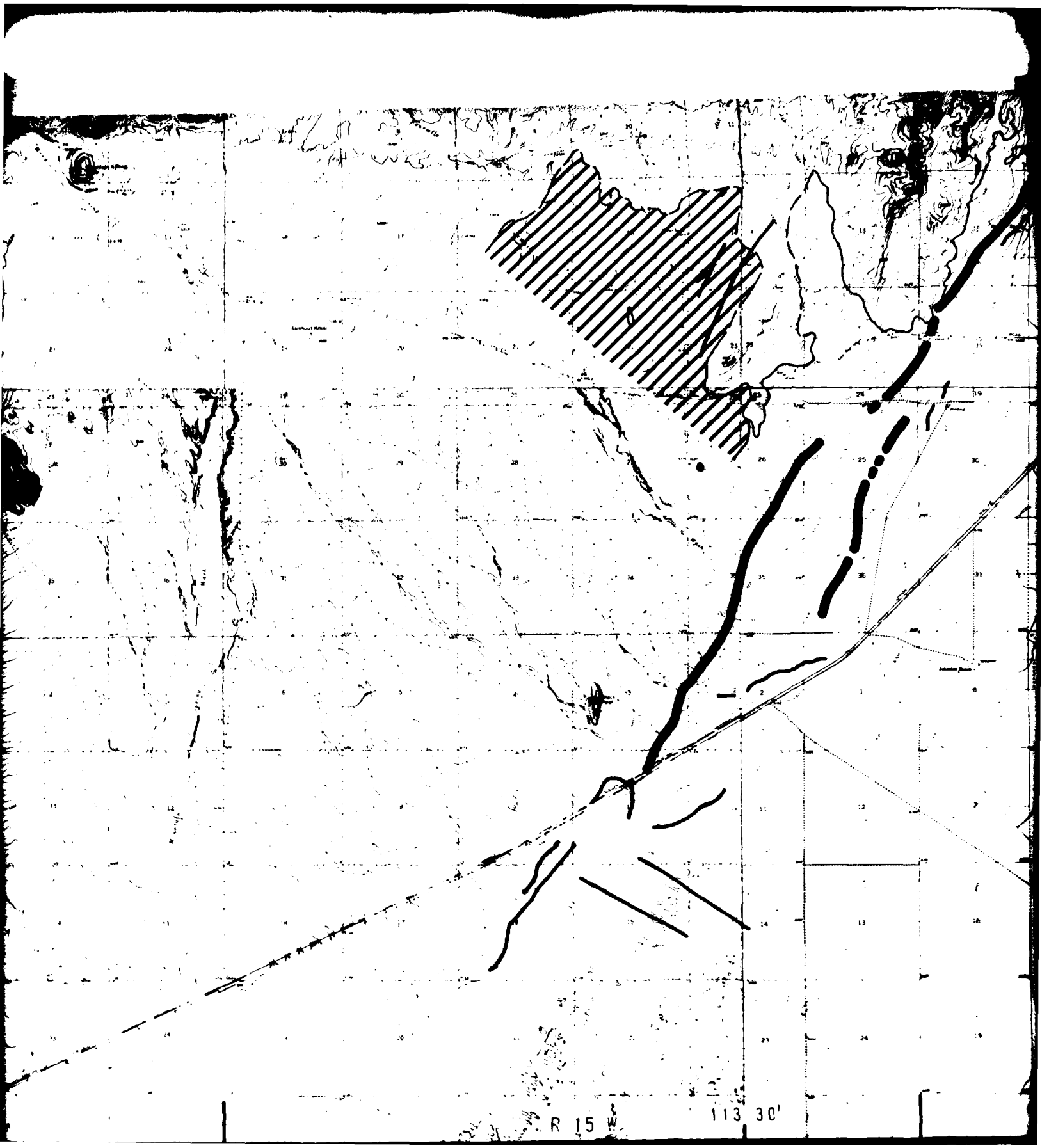

THE SINK
DITCH
BM 5135
BM 5120
BEAVER CO
IRON CO
Monument Knolls Reservoir
Old Barrister Mine
Knoll
Canyon
Spring
Mound Mtn
Badger Peak
B L A C K M O U
Hot Springs Canyon Pond
Valley
Third
Monuments
The Narrows

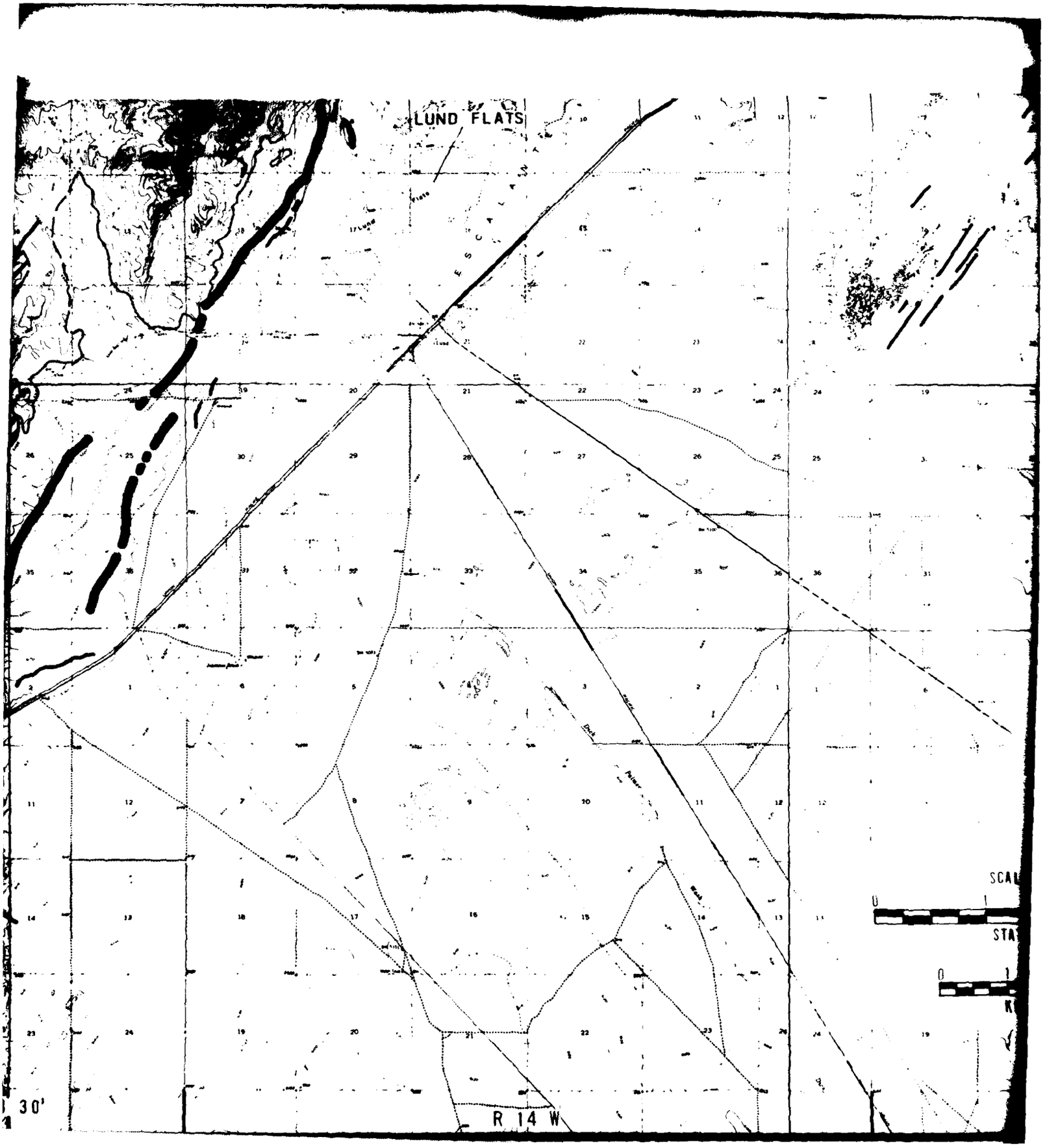

Ninemile Knoll
BM 5130
DITCH
BEAVER CO
IRON CO
Dry Wash
Mound Hill
M O U N T A I N S
Marshall Hill
Horse Valley
Little Horse Valley
The Narrows
Marshall Pond
Pennys Hollow Pond
Burnt Spot Pond
Gravel Pit

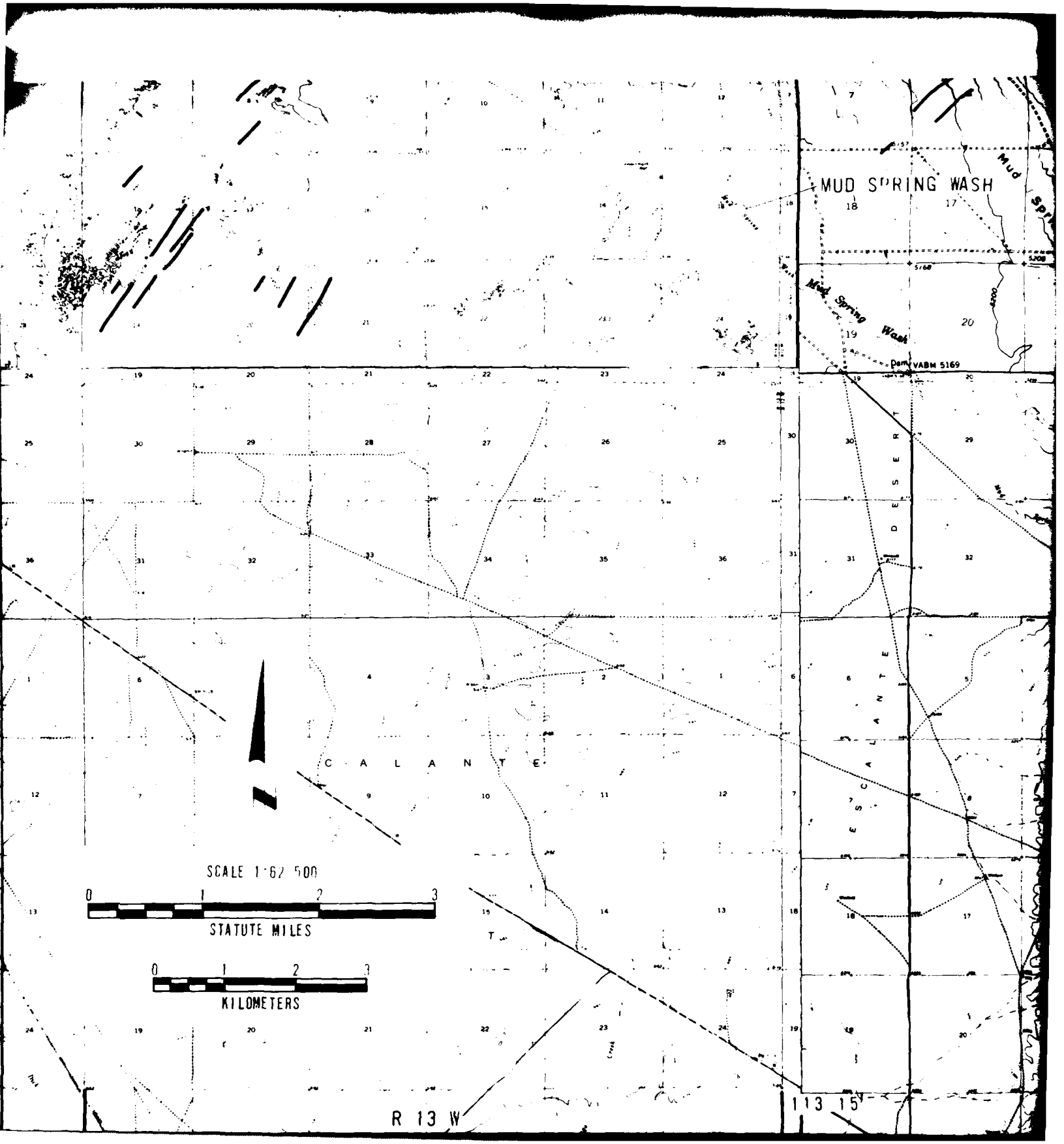

BM 5130
BEAVER CO
IRON CO
Dry Wash Springs
Ferney Hollow Pond
Ferney Hollow
Calaway Canyon
Burnt Spot Pond
Gravel Pit
Coyote Pond
Little Horse Valley
Marshall Pond
T 31 S

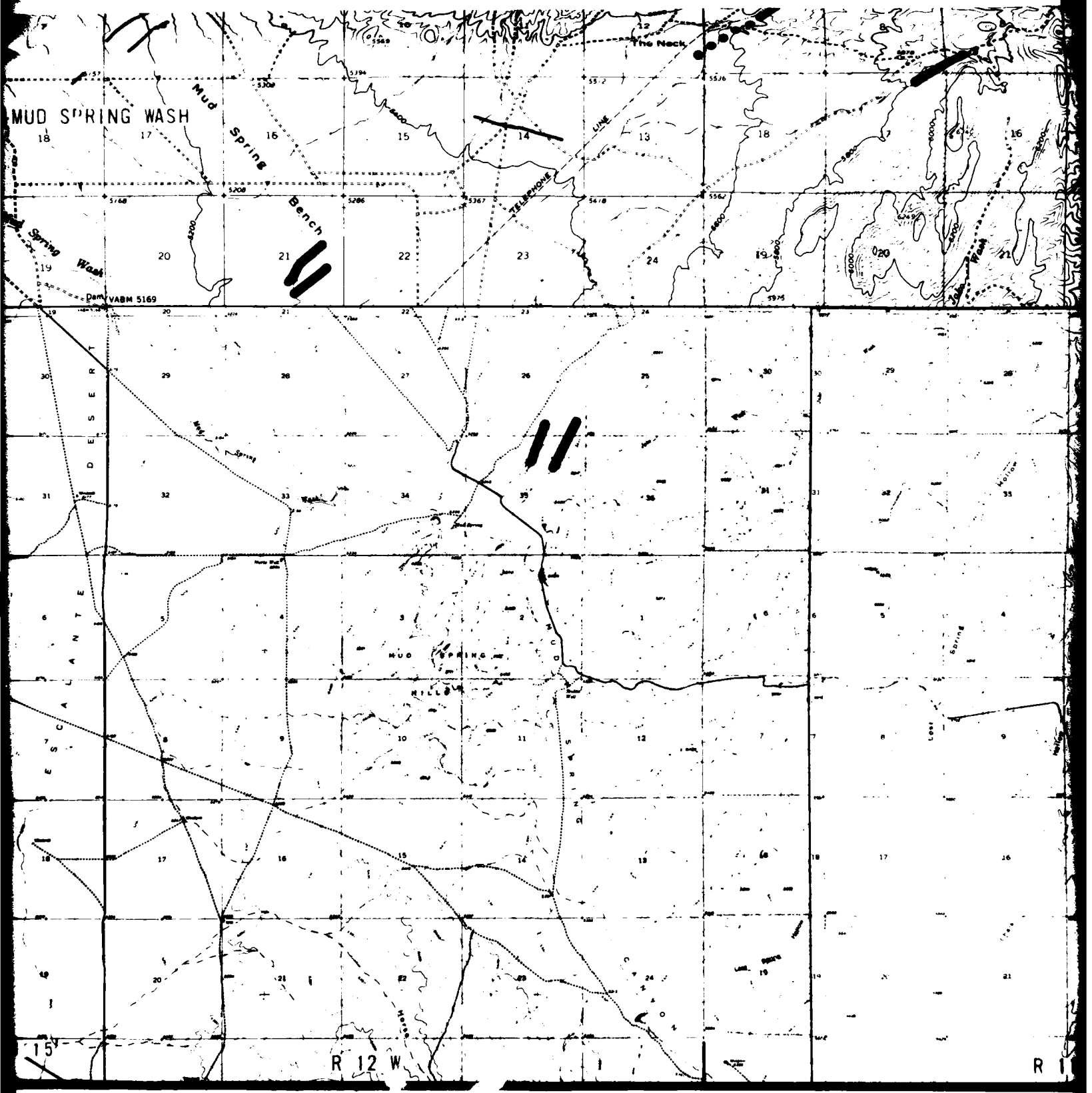


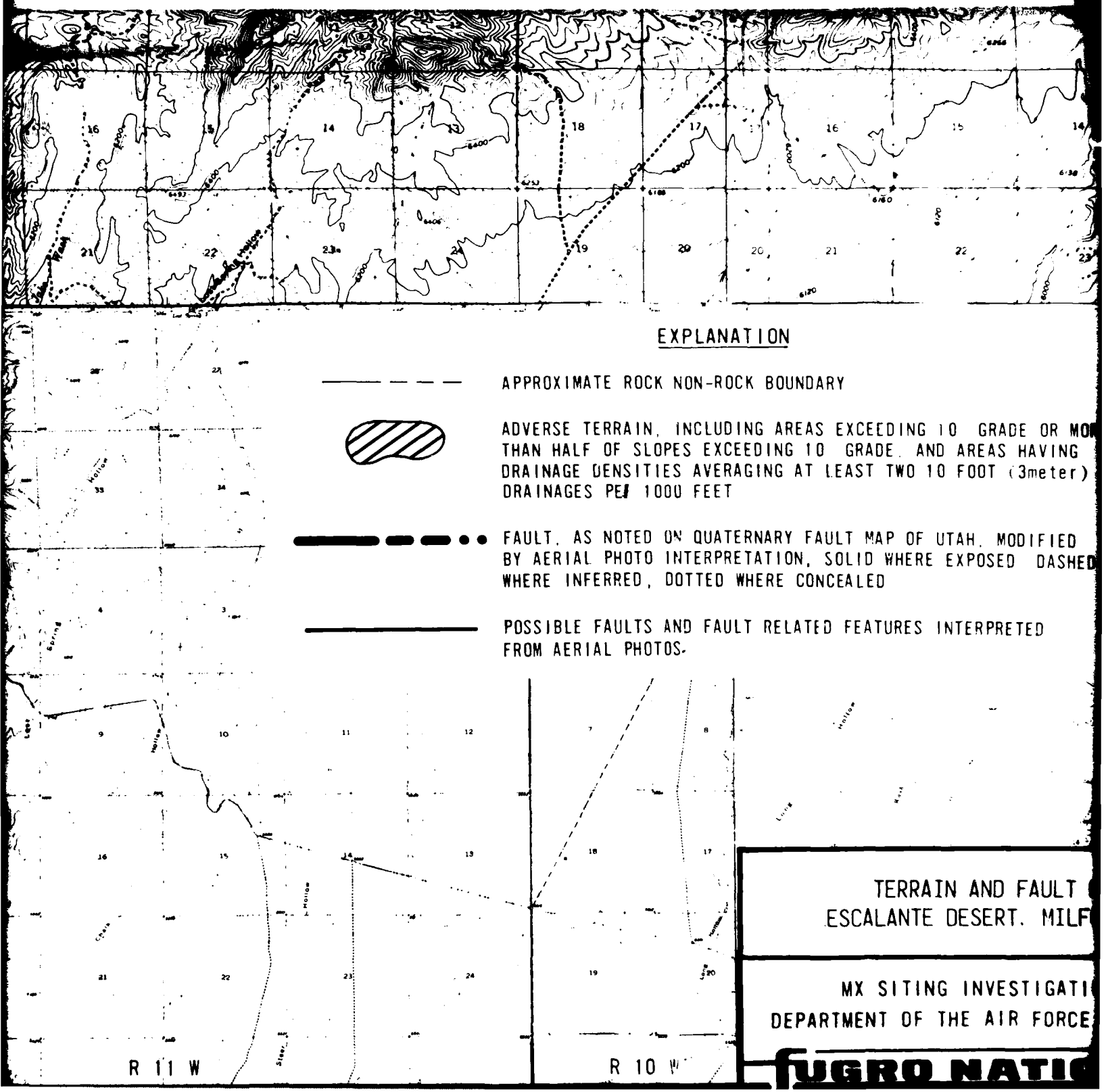
10 MAR 80


R 15 W
113 30'


LUND FLATS
30'
R 14 W


MUD SPRING WASH
Mud Spring Wash
Dam
VABM 5169
DESERT
ESCALANTE
C A L A N T E
SCALE 1:62 500
0 1 2 3
STATUTE MILES
0 1 2 3
KILOMETERS
R 13 W
113 15'


MUD SPRING WASH
Mud Spring
Bench
TELEPHONE LINE
The Neck
Spring Wash
Dam
VABM 5169
ESCALANTE DESERT
MUD SPRING HILLS
R 12 W
R 1



EXPLANATION

APPROXIMATE ROCK NON-ROCK BOUNDARY

ADVERSE TERRAIN, INCLUDING AREAS EXCEEDING 10 GRADE OR MO THAN HALF OF SLOPES EXCEEDING 10 GRADE, AND AREAS HAVING DRAINAGE DENSITIES AVERAGING AT LEAST TWO 10 FOOT (3meter) DRAINAGES PE 1000 FEET

FAULT, AS NOTED ON QUATERNARY FAULT MAP OF UTAH, MODIFIED BY AERIAL PHOTO INTERPRETATION, SOLID WHERE EXPOSED DASHED WHERE INFERRED, DOTTED WHERE CONCEALED

POSSIBLE FAULTS AND FAULT RELATED FEATURES INTERPRETED FROM AERIAL PHOTOS.

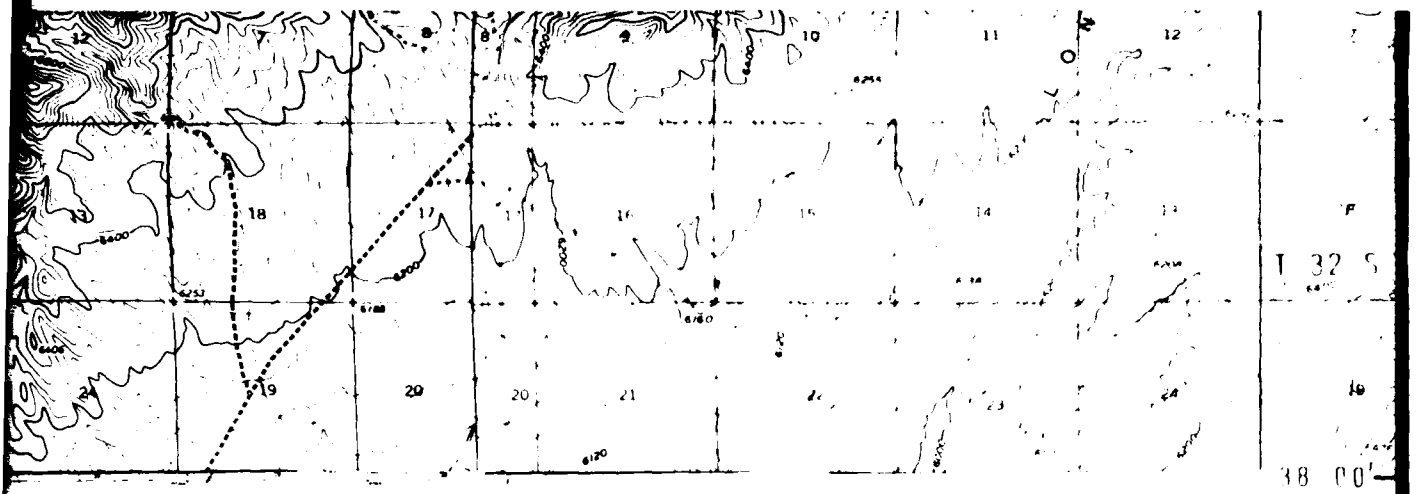
R 11 W

R 10 W

TERRAIN AND FAULT
ESCALANTE DESERT, MILF

MX SITING INVESTIGATI
DEPARTMENT OF THE AIR FORCE

FUGRO NATI



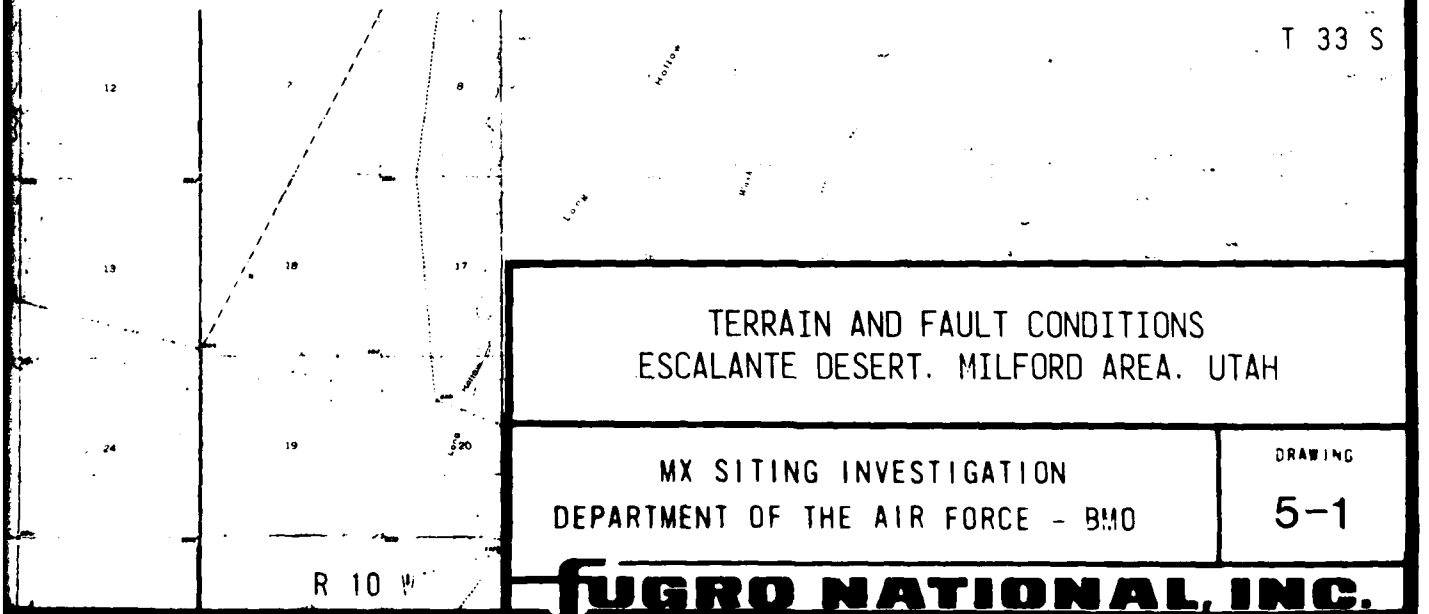
EXPLANATION

APPROXIMATE ROCK NON-ROCK BOUNDARY

ADVERSE TERRAIN, INCLUDING AREAS EXCEEDING 10 GRADE OR MORE THAN HALF OF SLOPES EXCEEDING 10 GRADE, AND AREAS HAVING DRAINAGE DENSITIES AVERAGING AT LEAST TWO 10 FOOT (3meter) DRAINAGES PER 1000 FEET

FAULT, AS NOTED ON QUATERNARY FAULT MAP OF UTAH, MODIFIED BY AERIAL PHOTO INTERPRETATION, SOLID WHERE EXPOSED DASHED WHERE INFERRED, DOTTED WHERE CONCEALED

POSSIBLE FAULTS AND FAULT RELATED FEATURES INTERPRETED FROM AERIAL PHOTOS.

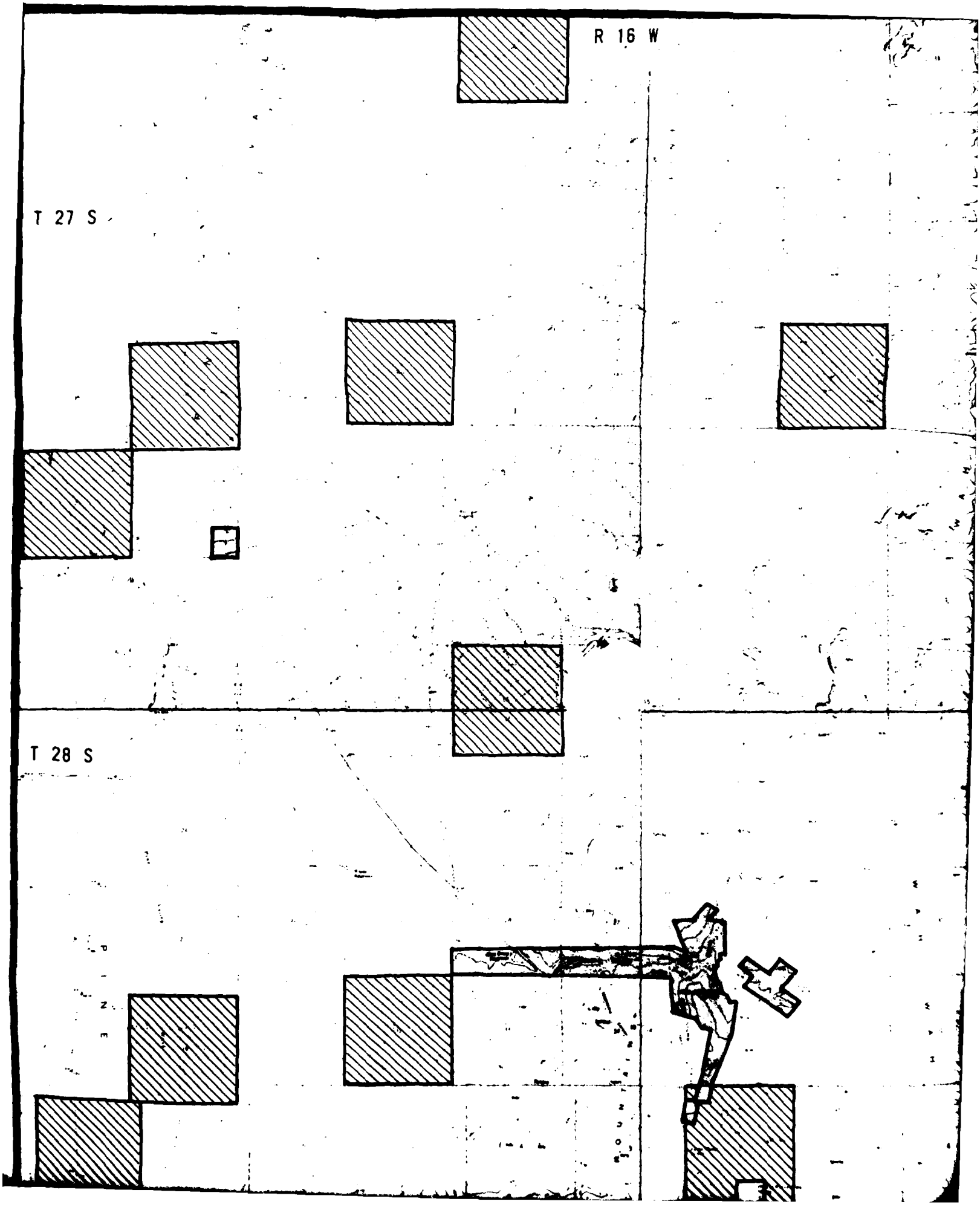


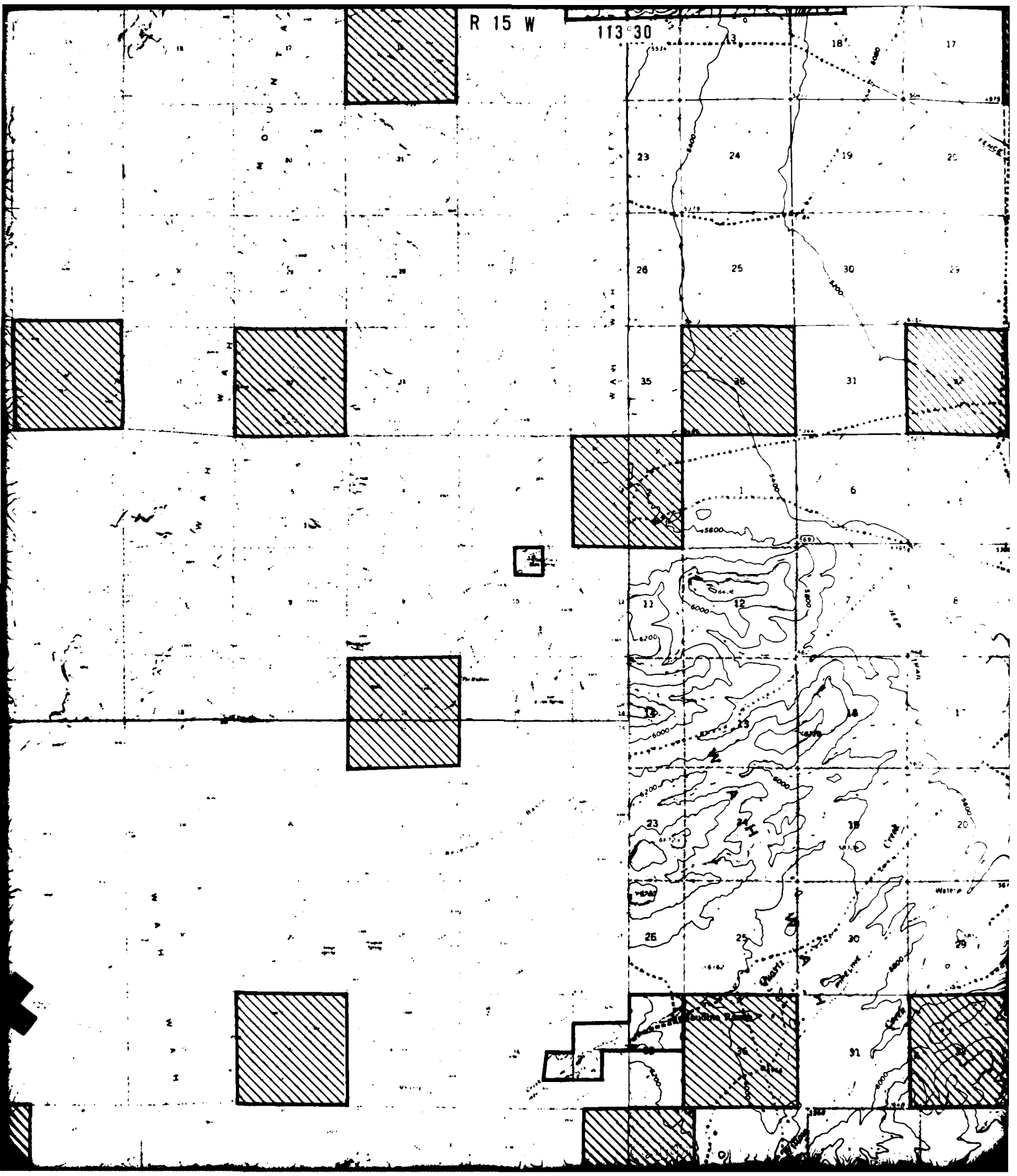
TERRAIN AND FAULT CONDITIONS
ESCALANTE DESERT, MILFORD AREA, UTAH

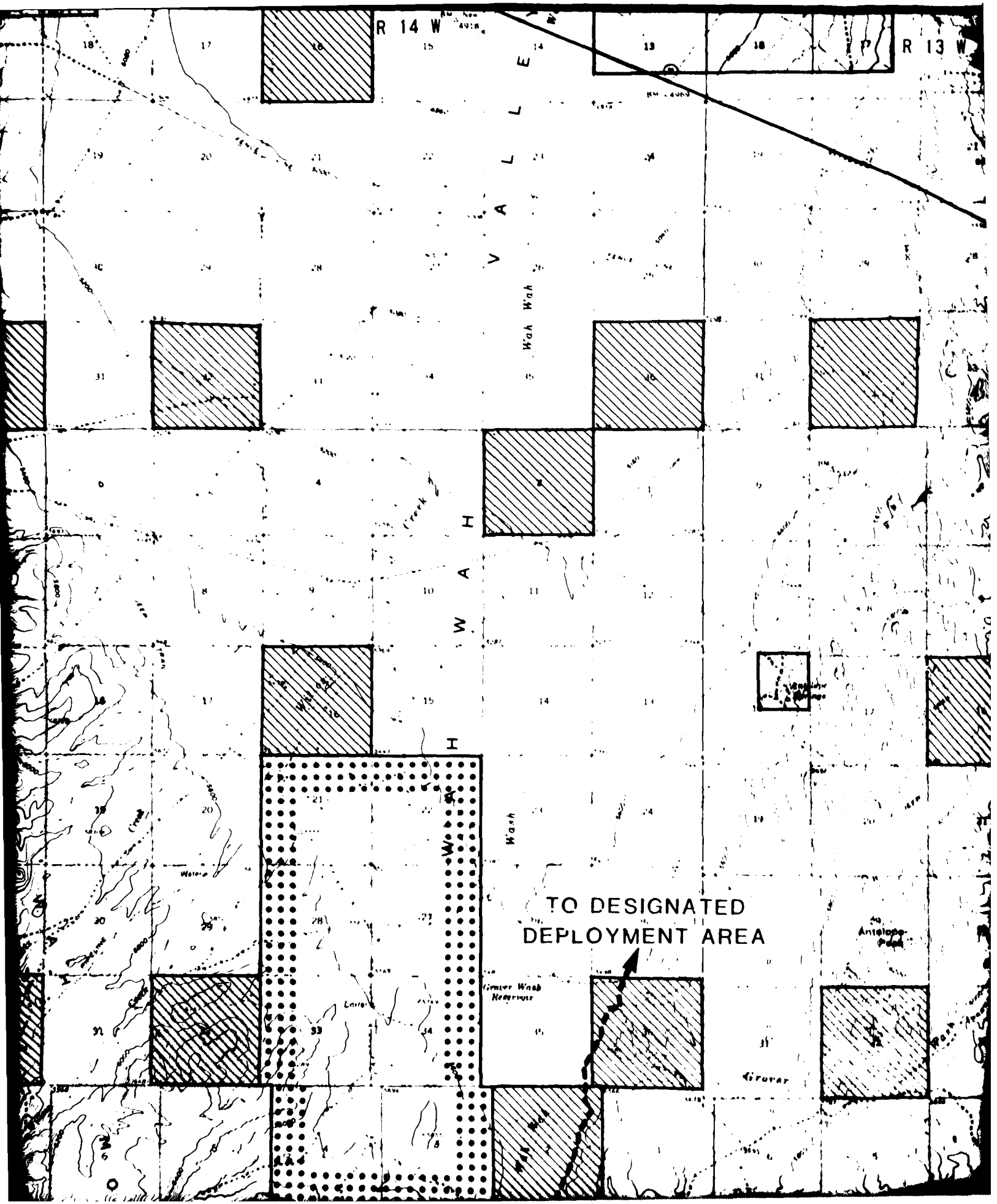
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

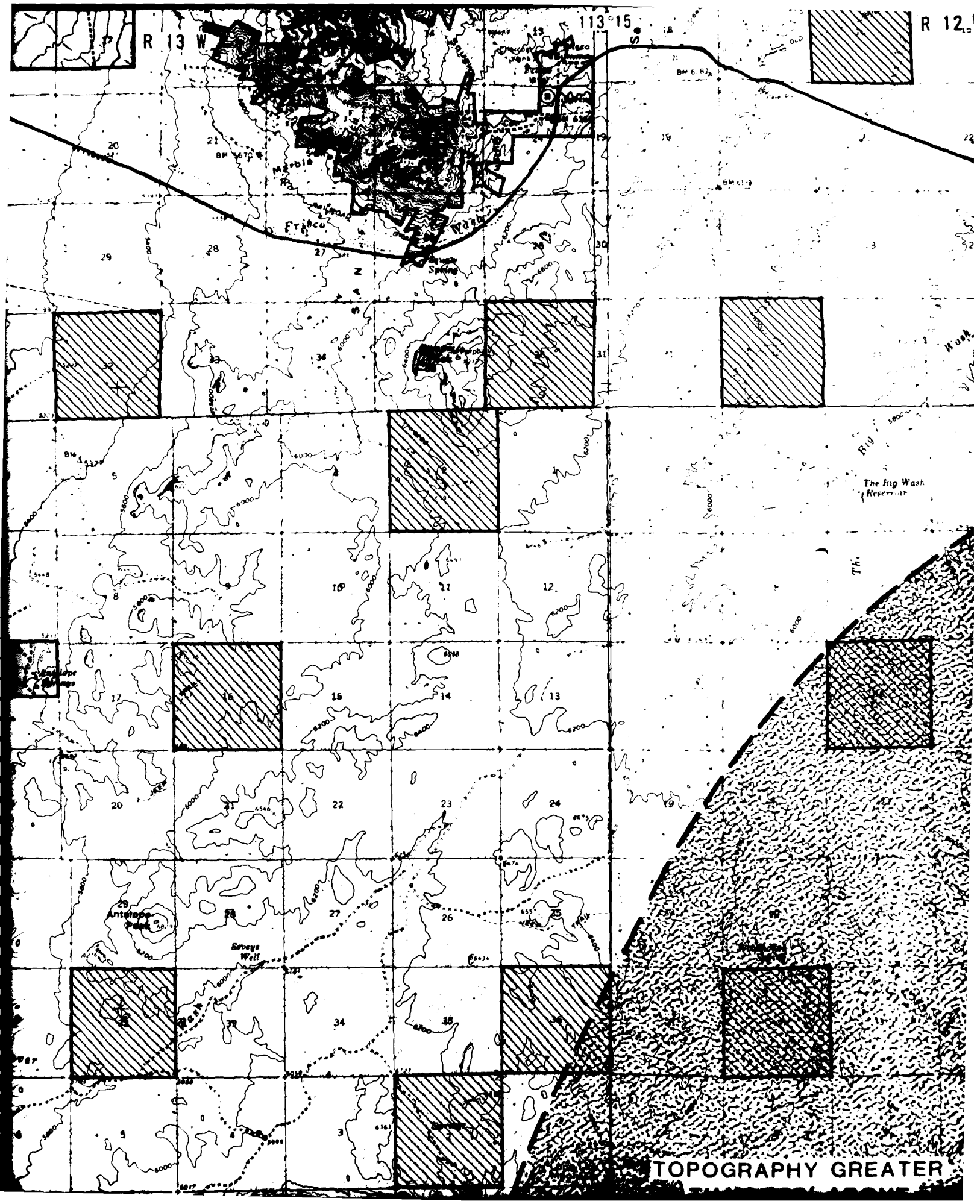
DRAWING
5-1

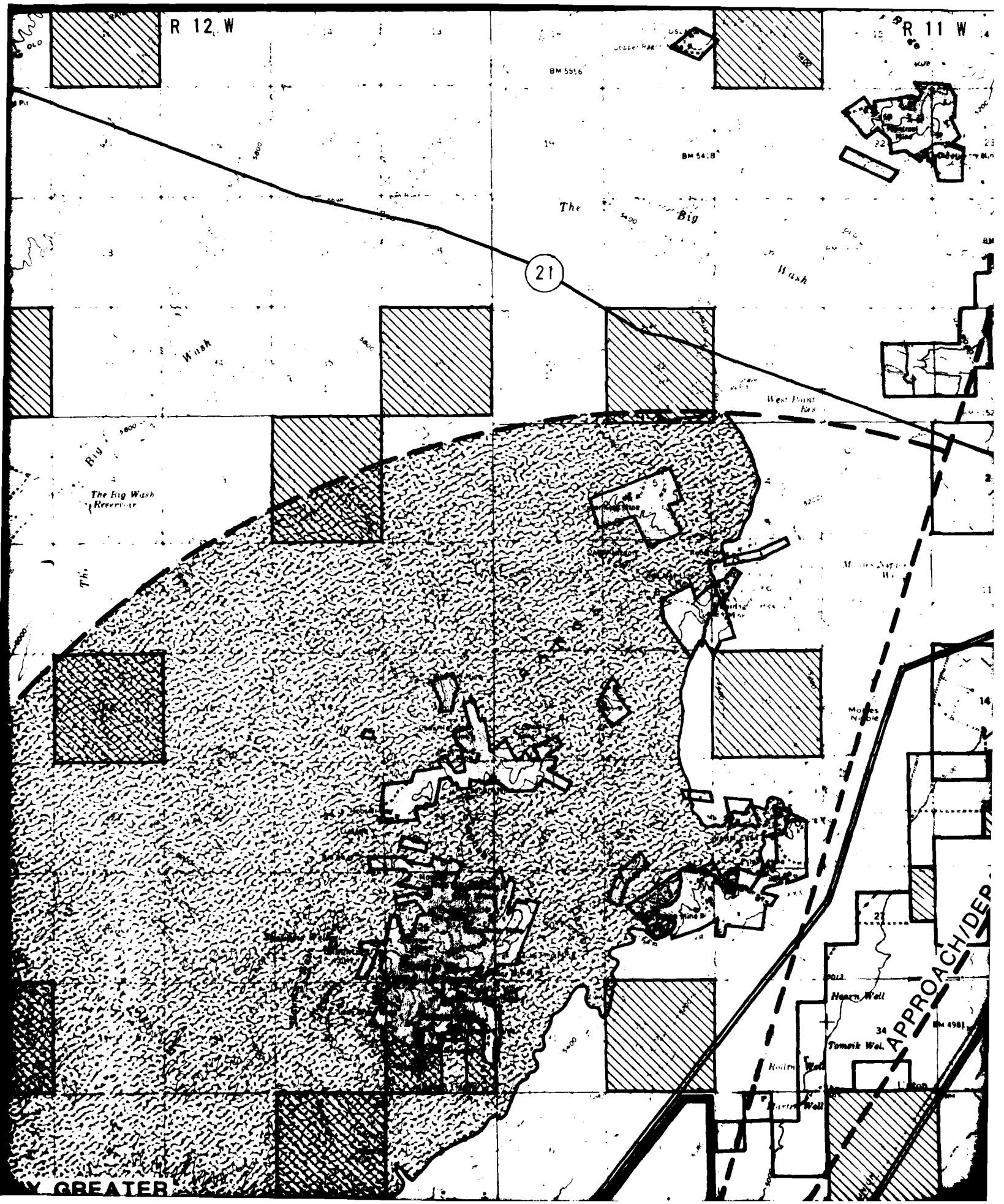
FUGRO NATIONAL, INC.

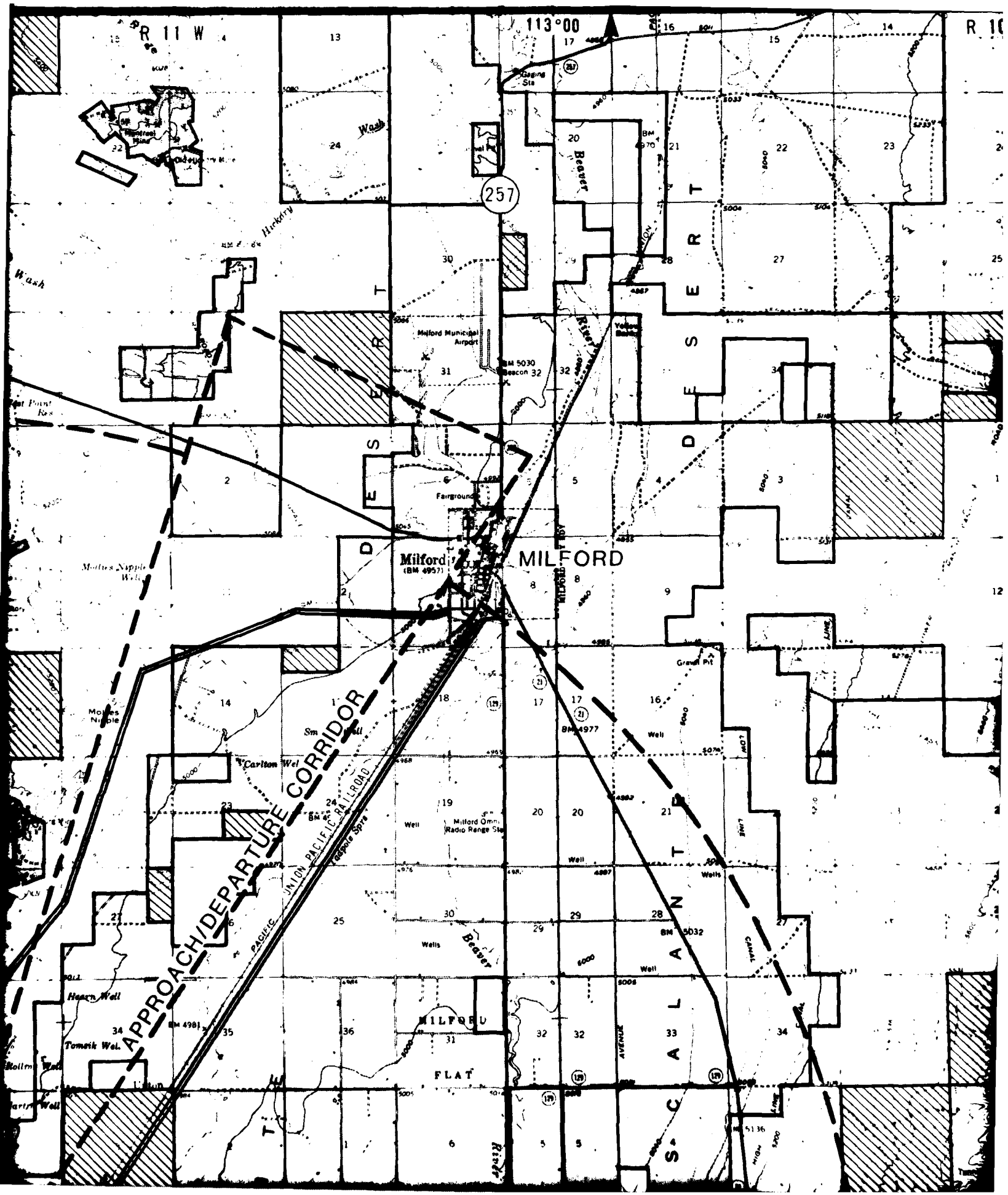

R 16 W
T 27 S
T 28 S

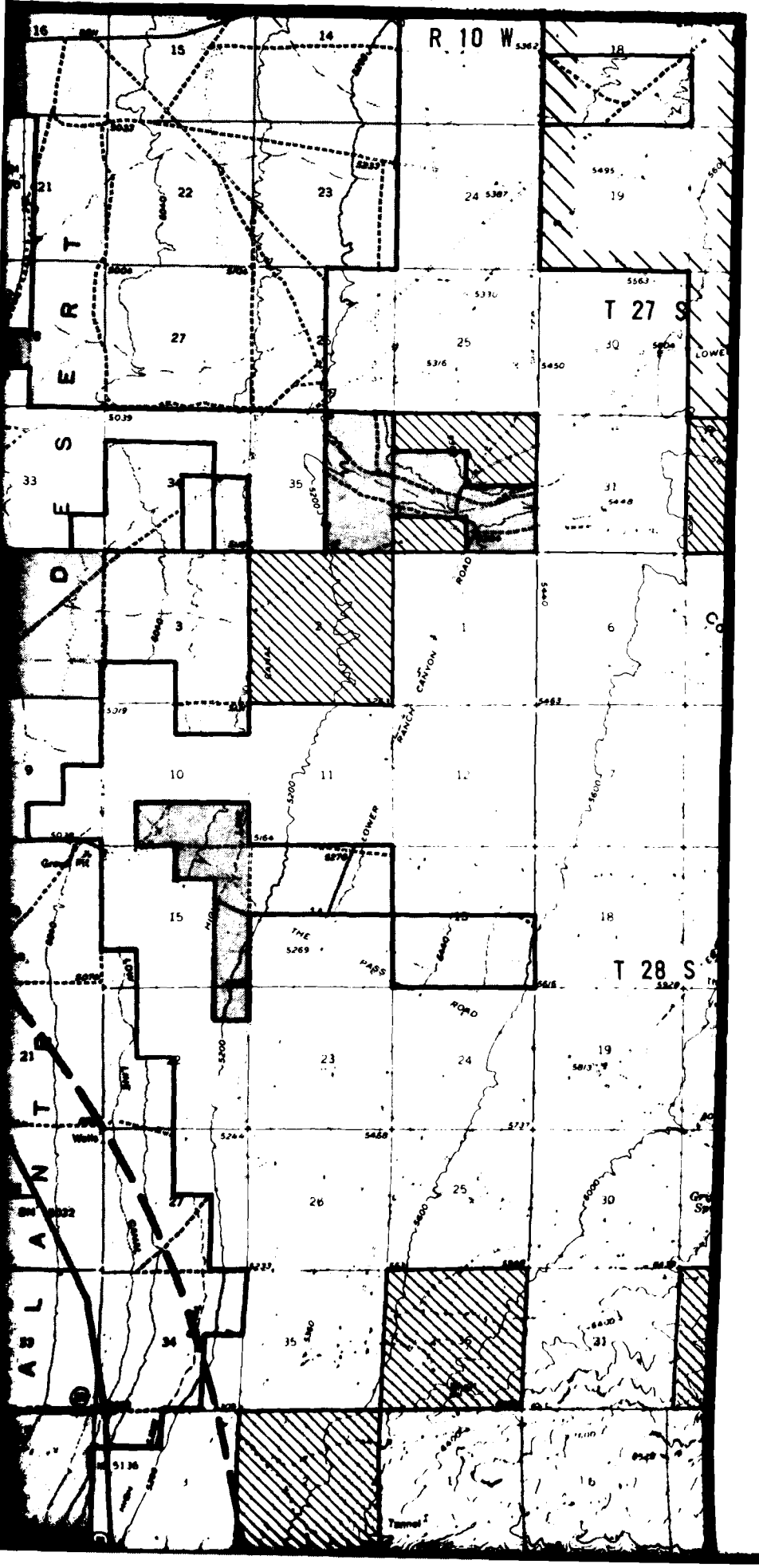

R 15 W
113°30'

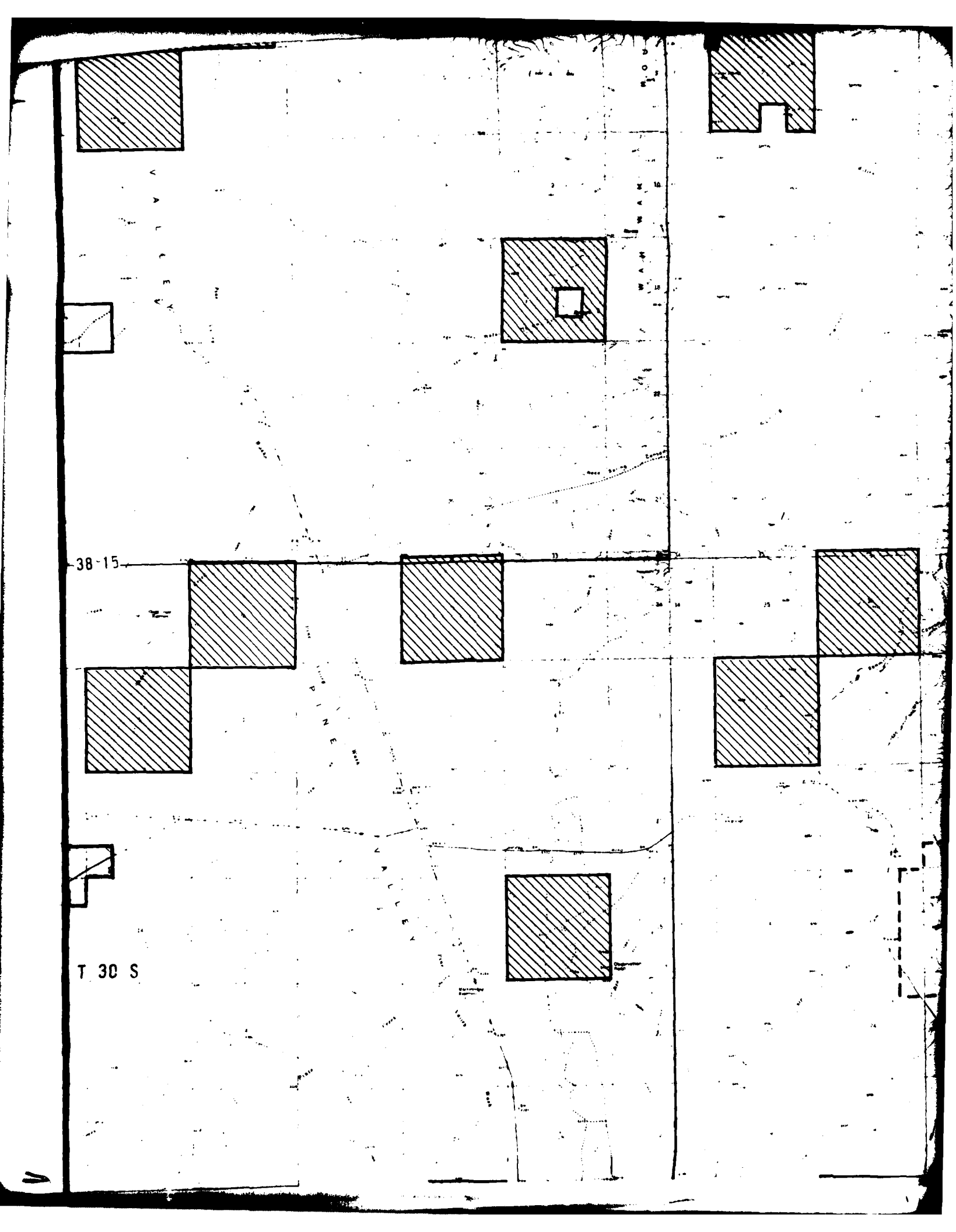

R 14 W
R 13 W
VALLEY
Wah Wah
WASHINGTON
Wash
TO DESIGNATED
DEPLOYMENT AREA

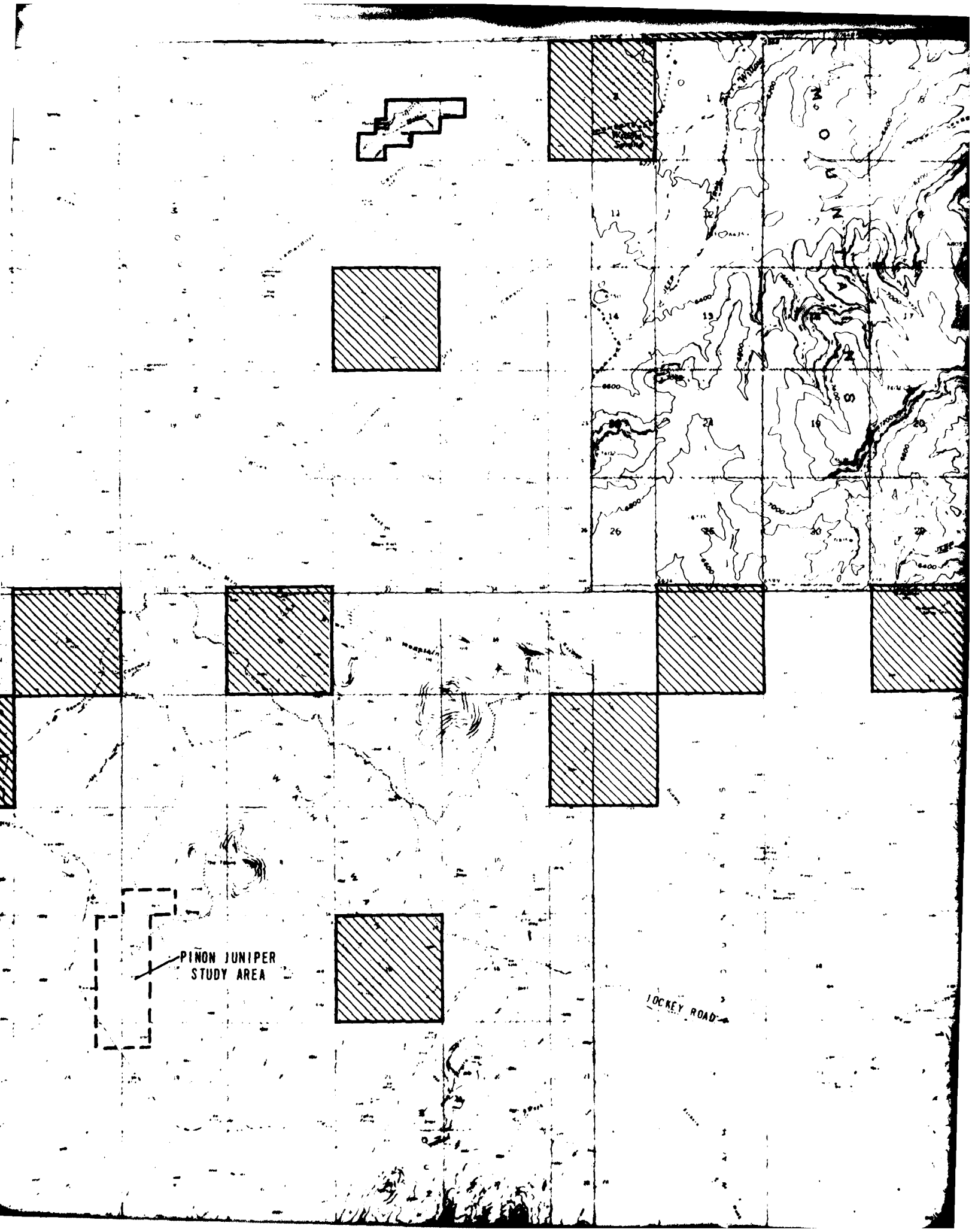

R 13 W
113°15'
R 12
Antelope Peak
Survey Well
The Big Wash Reservoir
TOPOGRAPHY GREATER

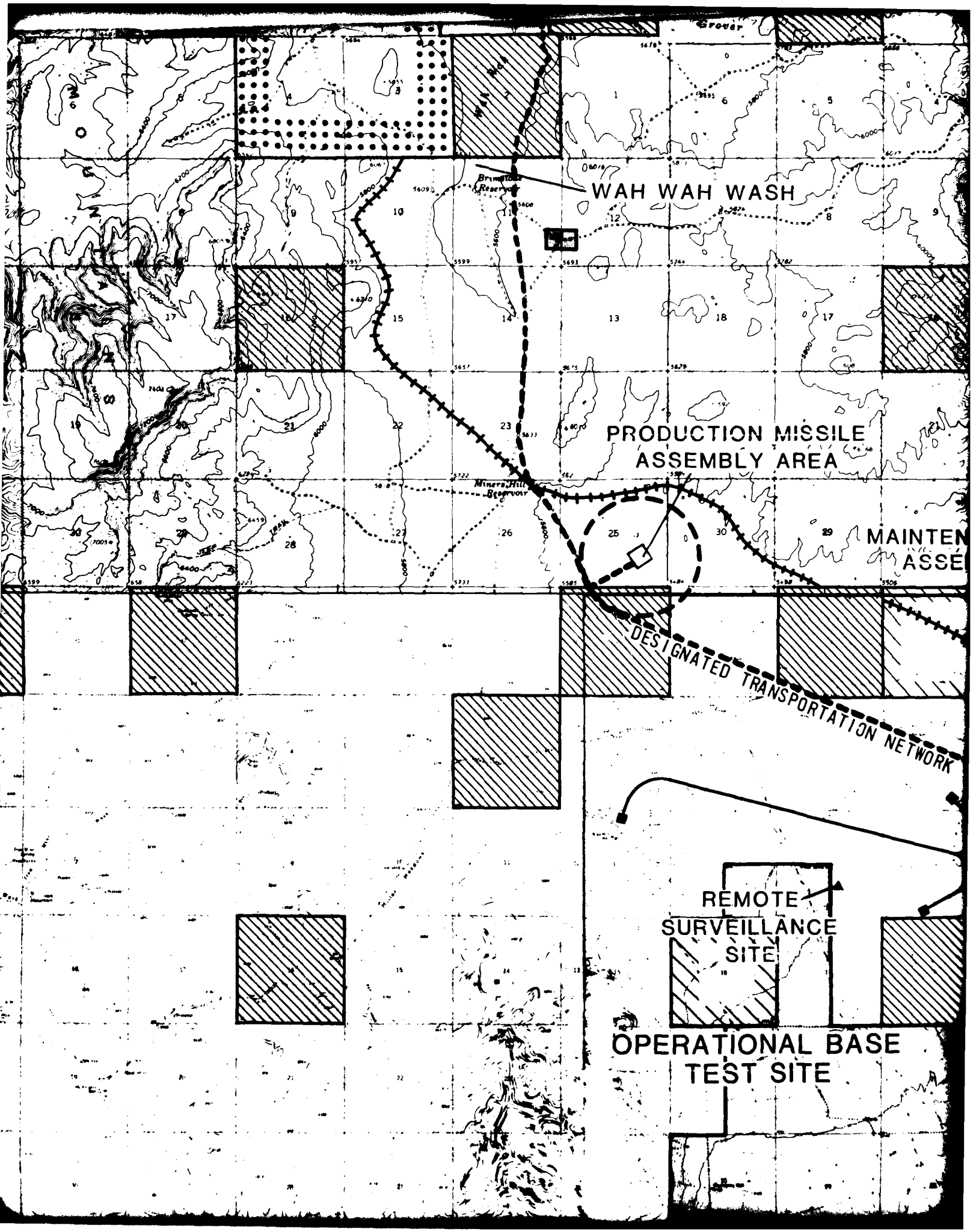

R 12 W
R 11 W
BM 5516
BM 5418
The Big Wash
21
Big Wash
West Point Run
The Big Wash Reservoir
Heaven Well
Tomek Well
APPROACH/DEP
GREATER

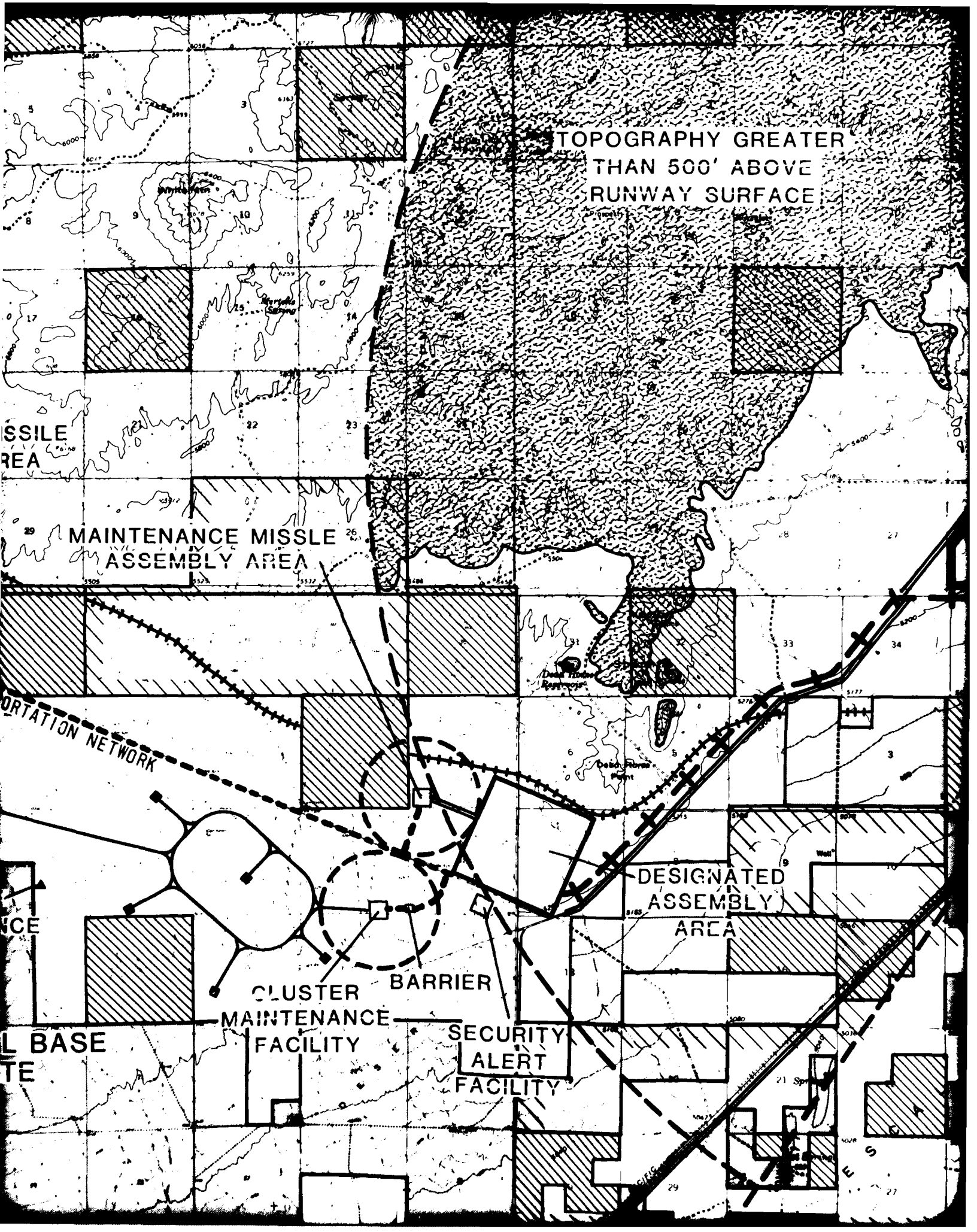

R 11 W
113°00
R 10
257
Hickory
Wash
Beaver
Dam
Wash
Milford Municipal Airport
BM 5030
Beacon
Yellow Knoll
Fairground
Milford
(BM 4957)
MILFORD
DESERT
SCALANTE
Grand Pit
Well
Carlton Wel
Sm Well
Milford Omni
Radio Range Sta
Wells
Beaver
Heaton Well
Tomsik Wel.
MILFORD
FLAT
APPROACH/DEPARTURE CORRIDOR
UNION PACIFIC RAILROAD
Gypsum Spur
Meadow
Canal
Avenue

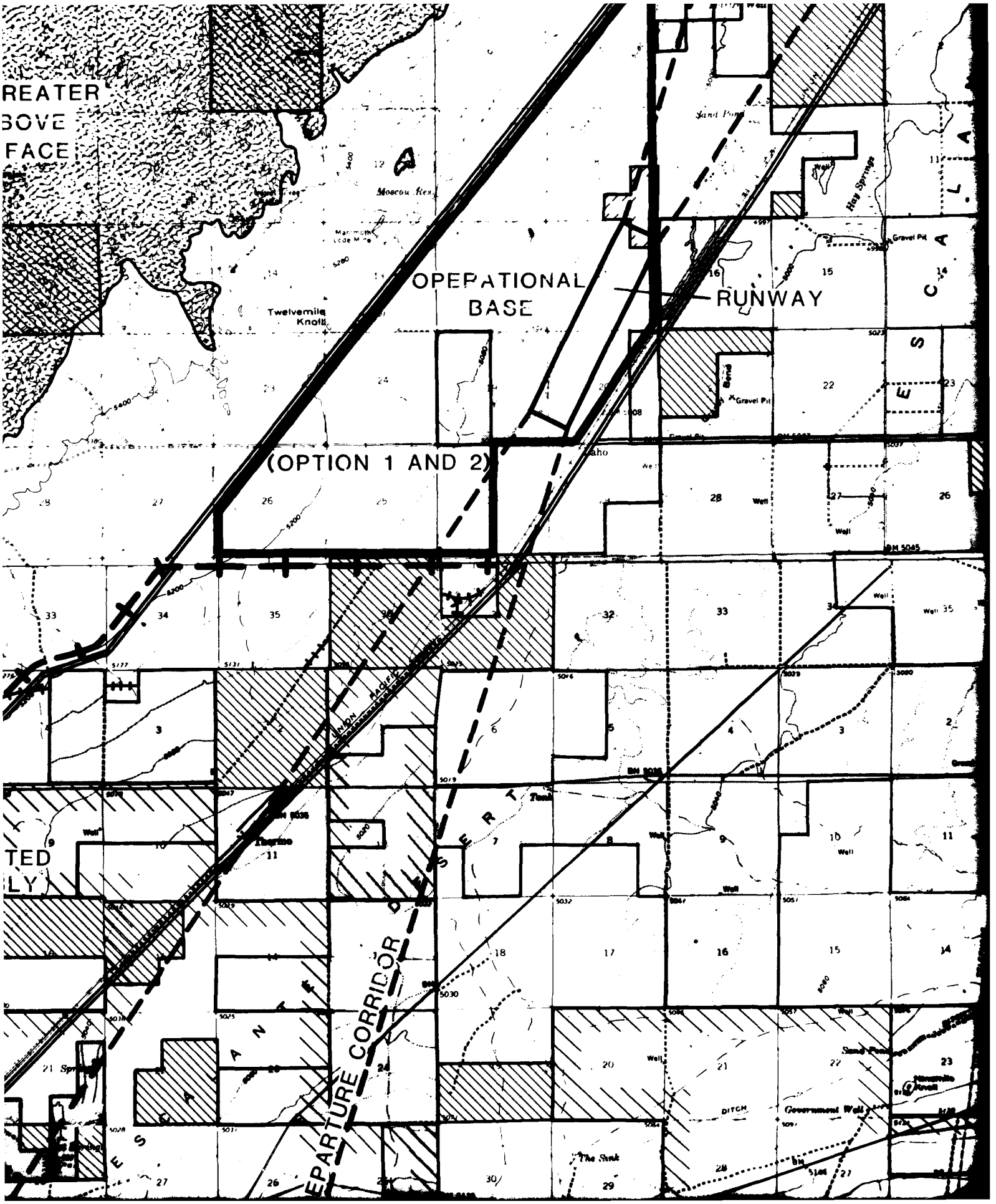

R 10 W
T 27 S
T 28 S
DESERT
ATLANTIC
ROAD
CANYON
RANCH
PASS
THE
LOWER

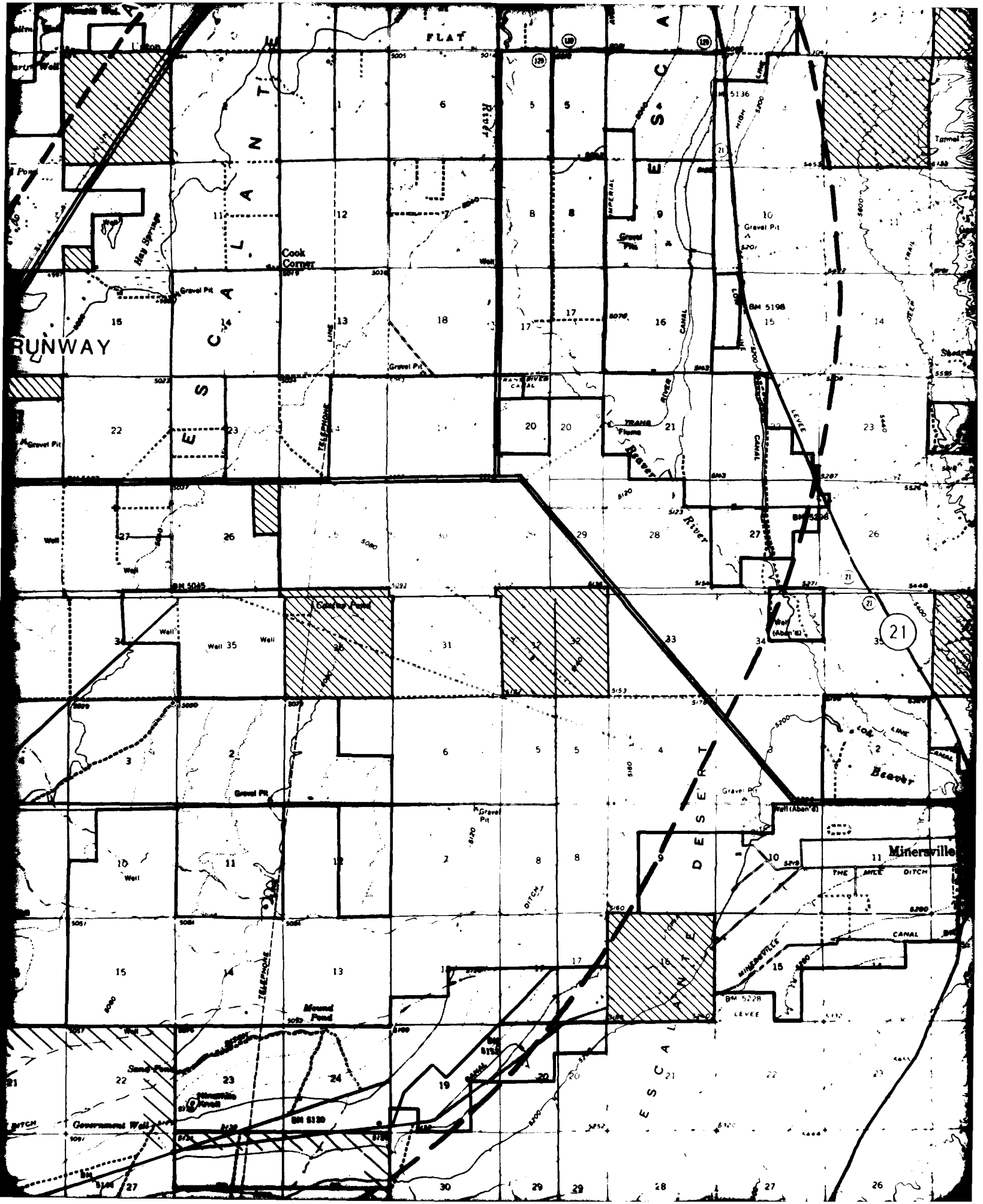

38-15
T 30 S

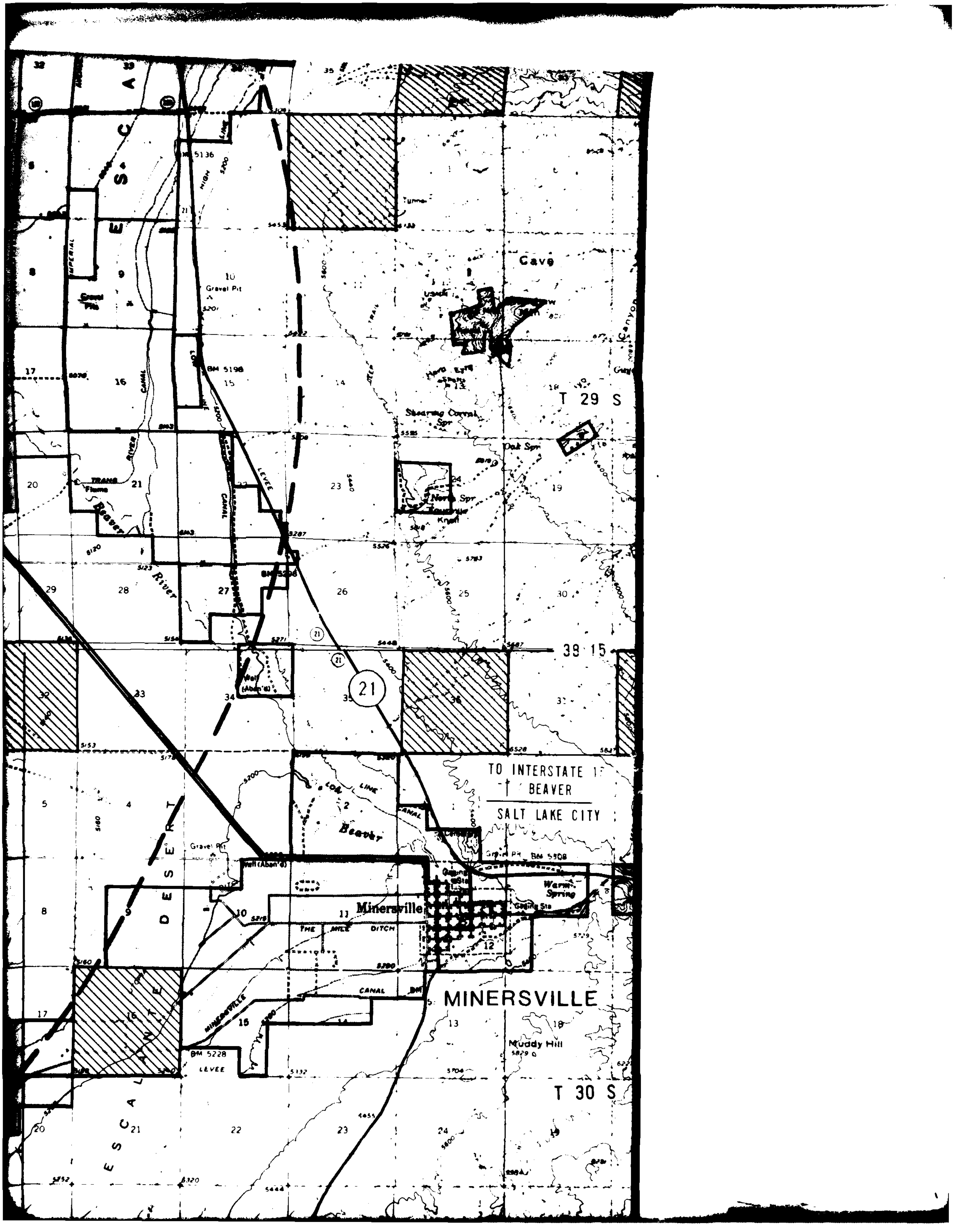

PINON JUNIPER
STUDY AREA
JOCKEY ROAD


WAH WAH WASH
PRODUCTION MISSILE ASSEMBLY AREA
MAINTEN
ASSE
DESIGNATED TRANSPORTATION NETWORK
REMOTE SURVEILLANCE SITE
OPERATIONAL BASE TEST SITE

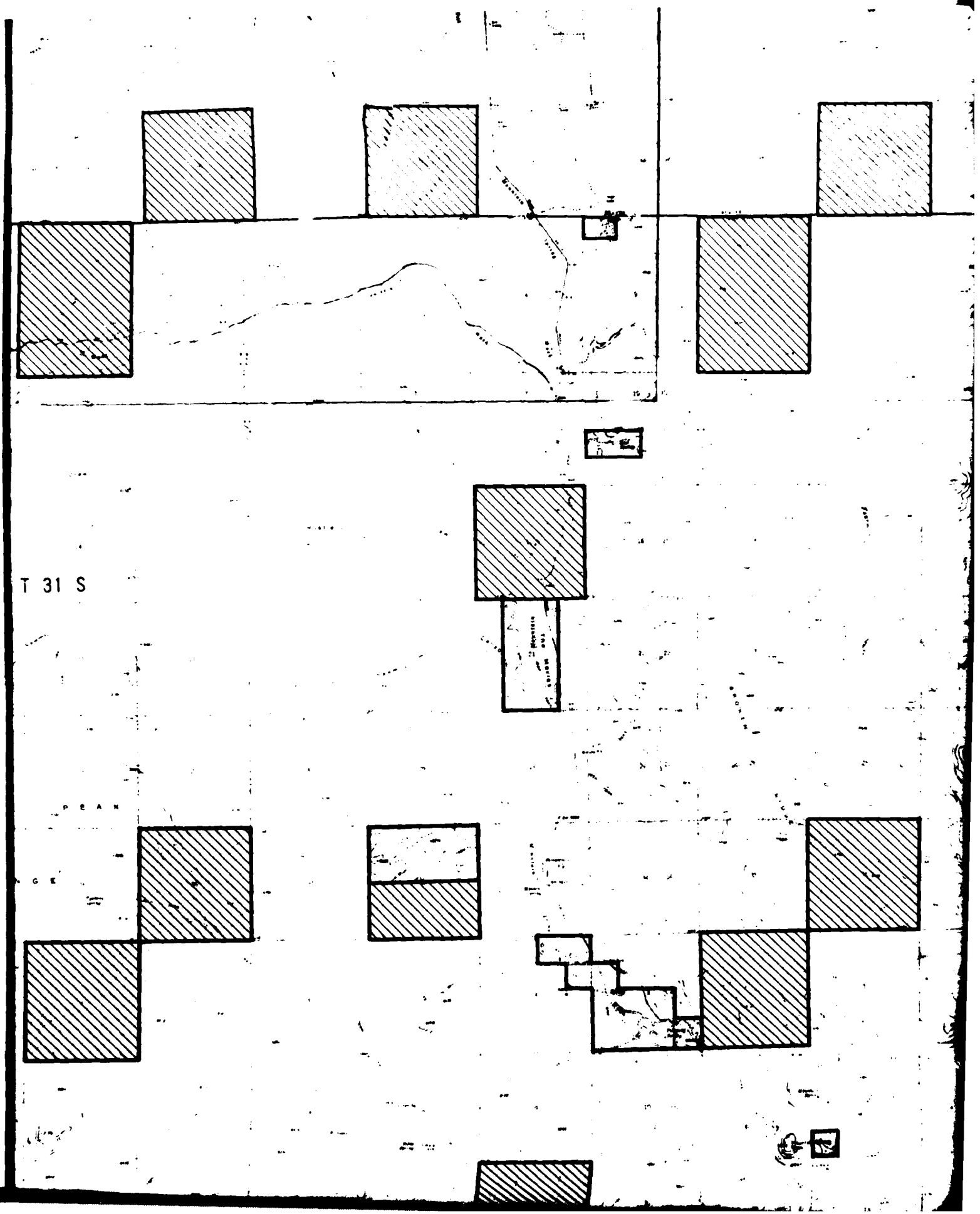

TOPOGRAPHY GREATER
THAN 500' ABOVE
RUNWAY SURFACE
MAINTENANCE MISSLE
ASSEMBLY AREA
DESIGNATED
ASSEMBLY
AREA
BARRIER
CLUSTER
MAINTENANCE
FACILITY
SECURITY
ALERT
FACILITY

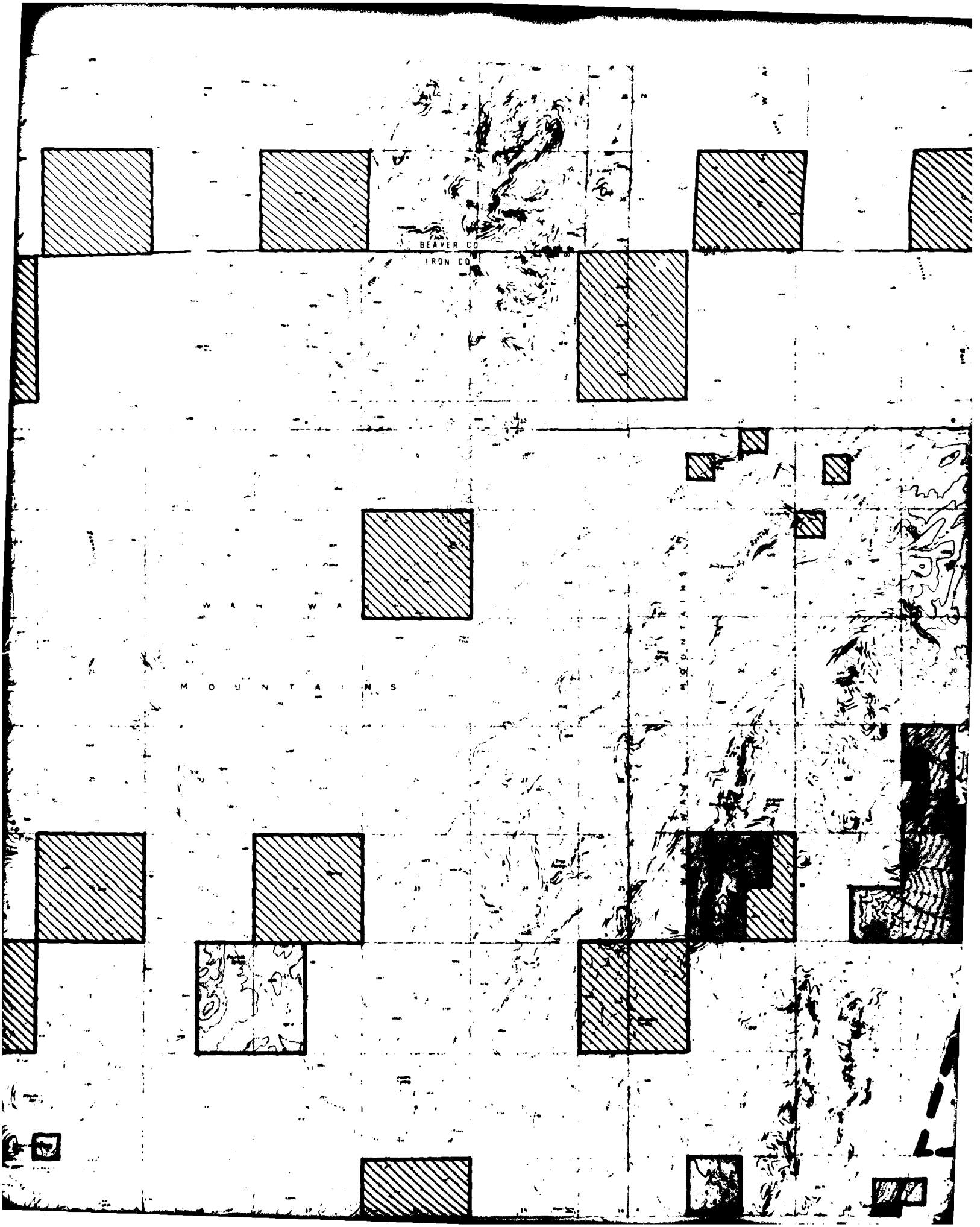

REATER
BOVE
FACE
OPERATIONAL
BASE
RUNWAY
(OPTION 1 AND 2)
Twelvemile
Knoll
Moscow Res.
Gravel Pit
Well
Idaho
Union Pacific
DEPARTURE CORRIDOR
DESERT
SCALE
TED
LY
Government Well
The Sink
DITCH

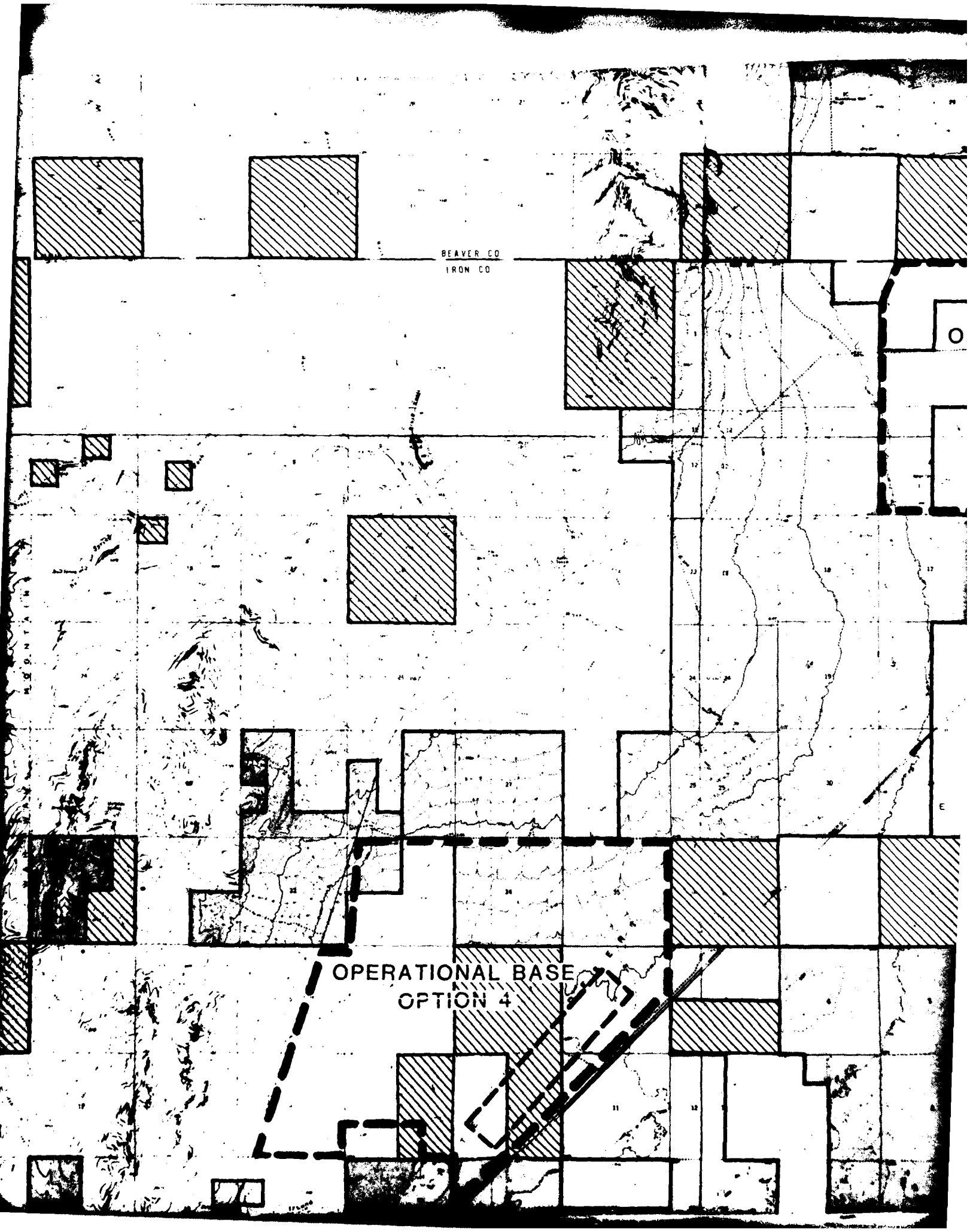

FLAT
SALTON SEA
Cook Corner
Hay Springs
Gravel Pit
RUNWAY
ESCALANTE
TELEPHONE
Gravel Pit
TRANS Flume
Beaver
Beaver
Minersville
MINERSVILLE
Mound Pond
Government Well
ESCALANTE DESERT
BM 5136
BM 5198
BM 5045
BM 5228
BM 5130
Well 35
Well
Well (Aban'd)
Tunnel
Levee
Canal
Ditch
21

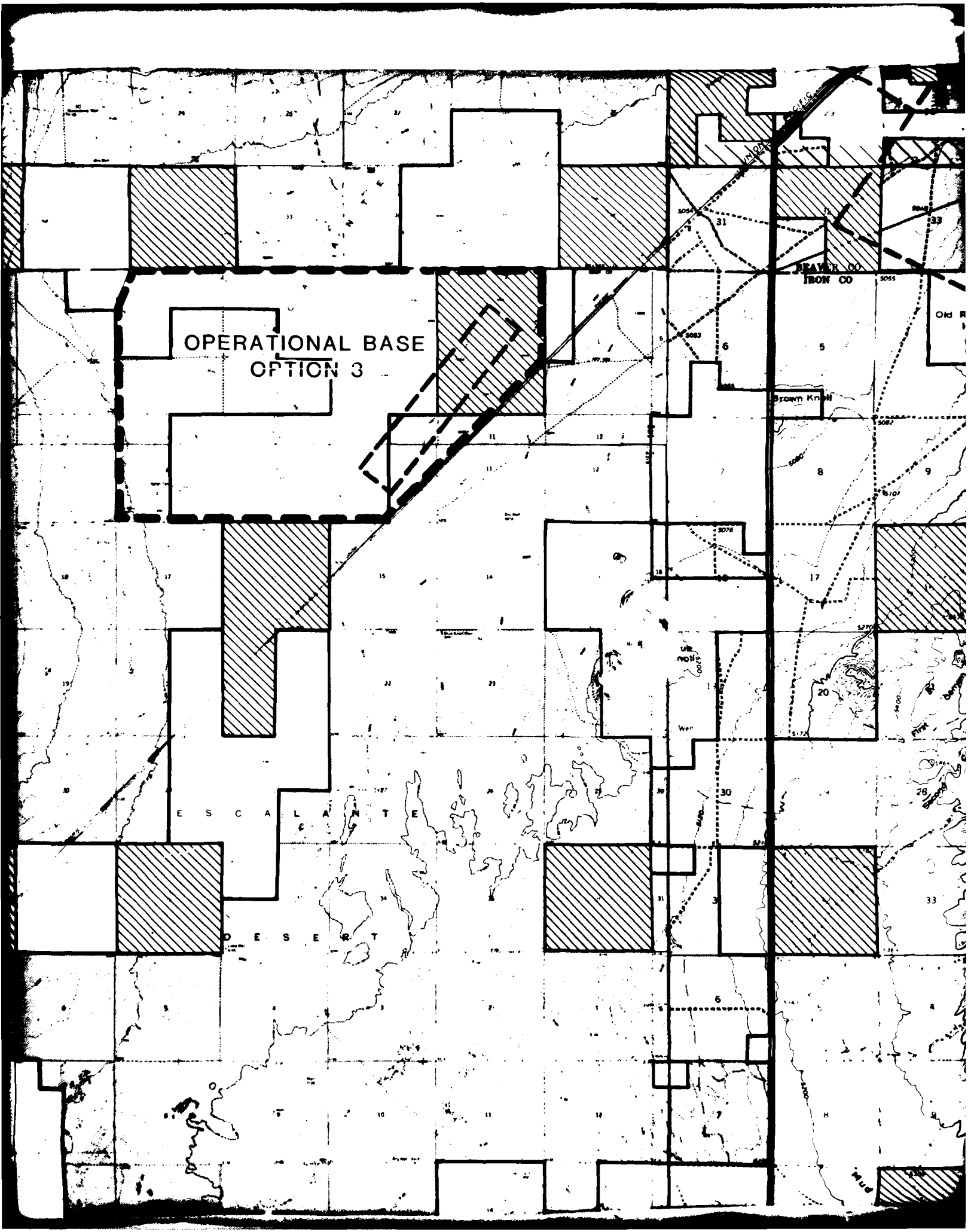


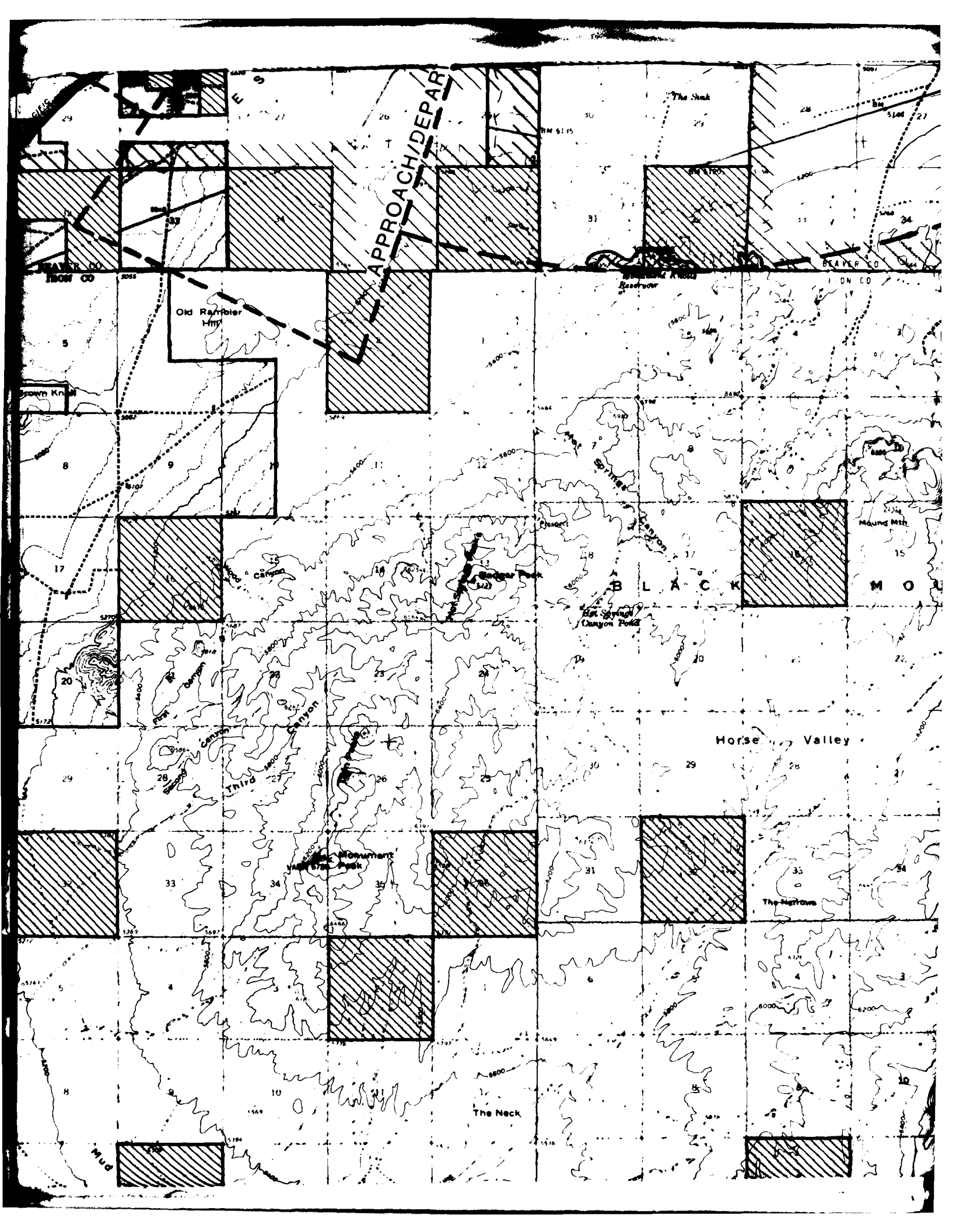
Cave
Canyon
T 29 S
Shearing Corral Spr
North Spr
Oak Spr
Gravel Pit
BM 5136
BM 5198
LEVEE
CANAL
Beaver River
Well (Aban'd)
21
TO INTERSTATE 15
BEAVER
SALT LAKE CITY
Warm Spring
Minersville
THE MILE DITCH
MINERSVILLE
Muddy Hill
BM 5228
T 30 S
ESCALANTE DESERT

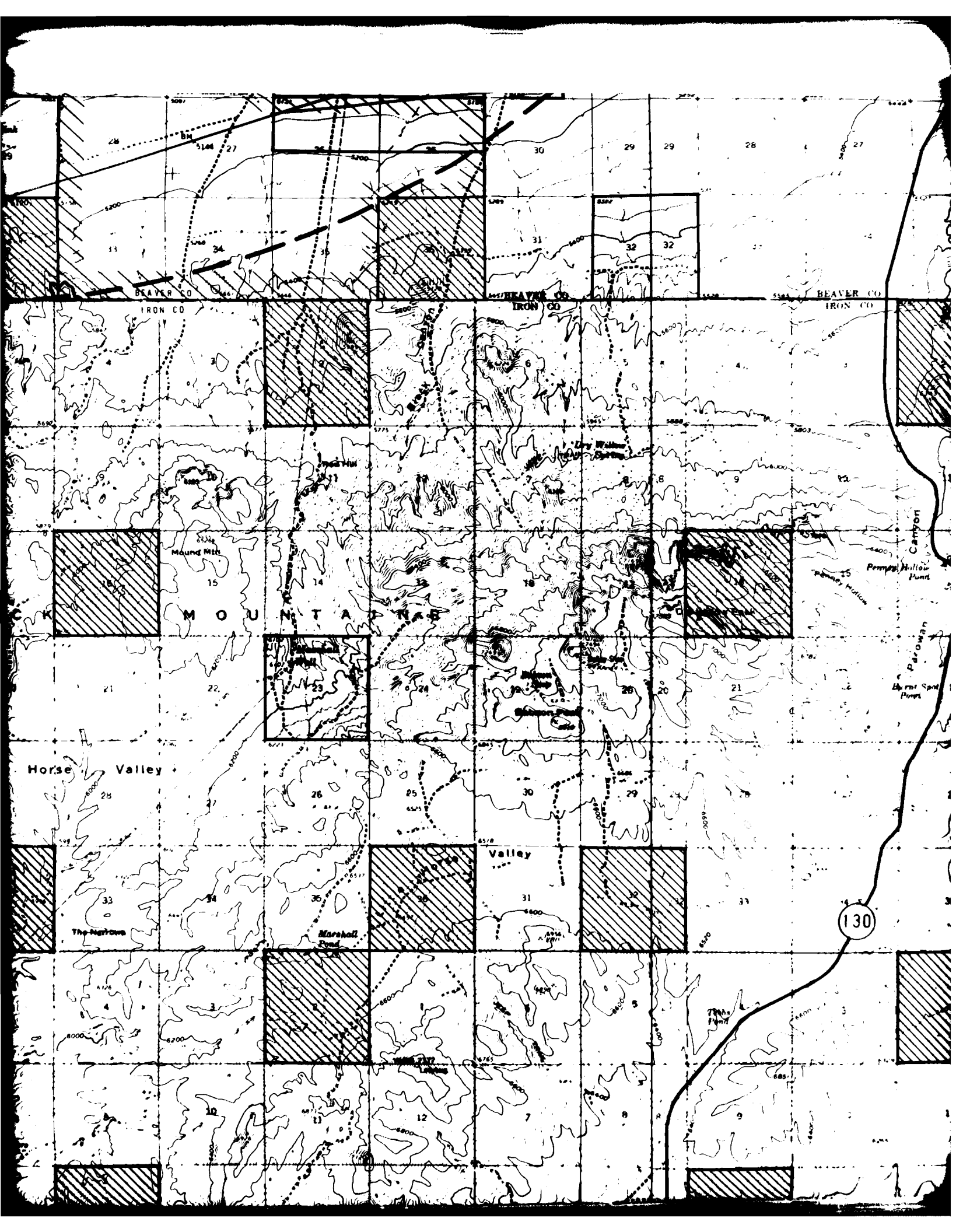

T 31 S

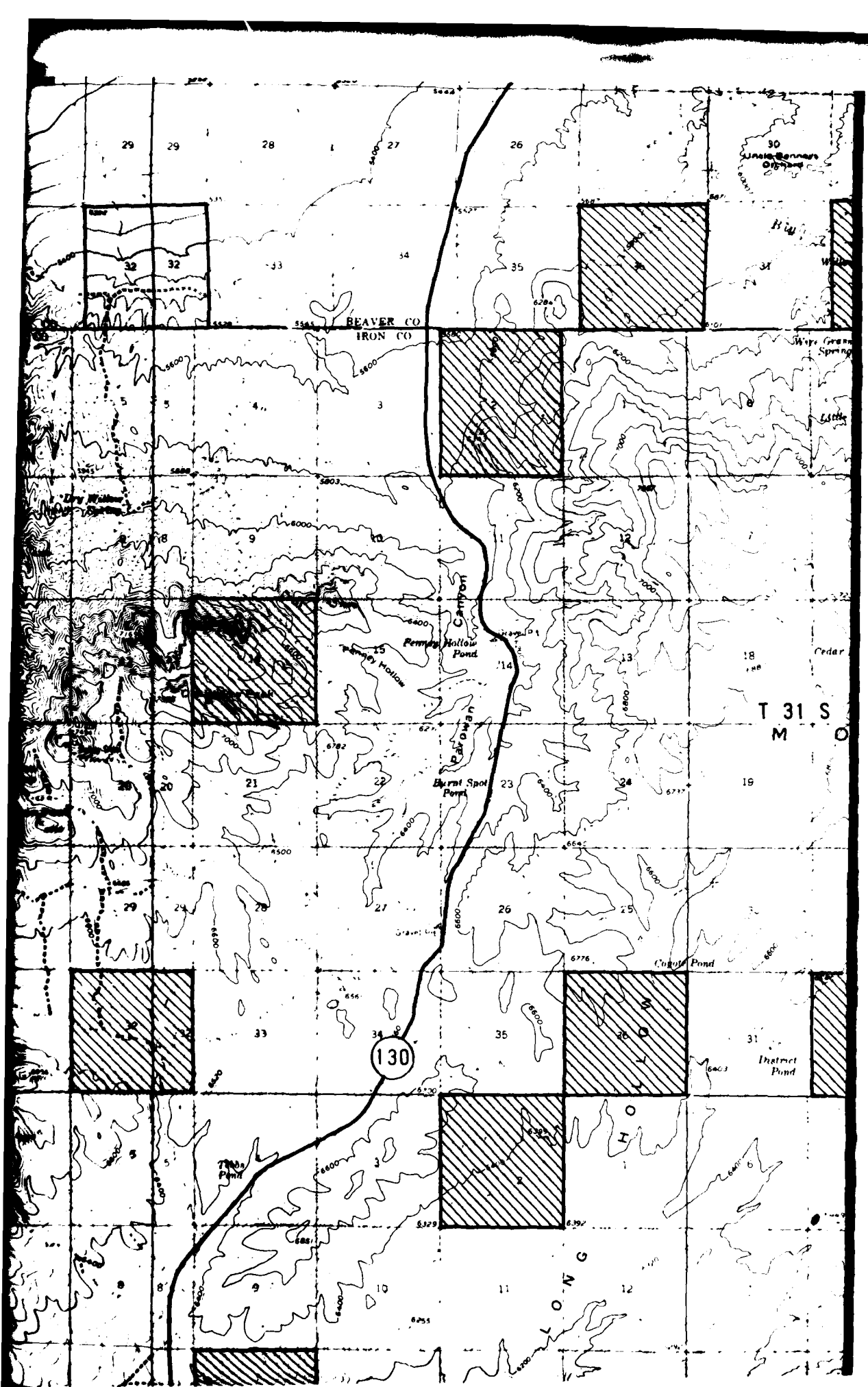

BEAVER CO
IRON CO
W A H W A
M O U N T A I N S

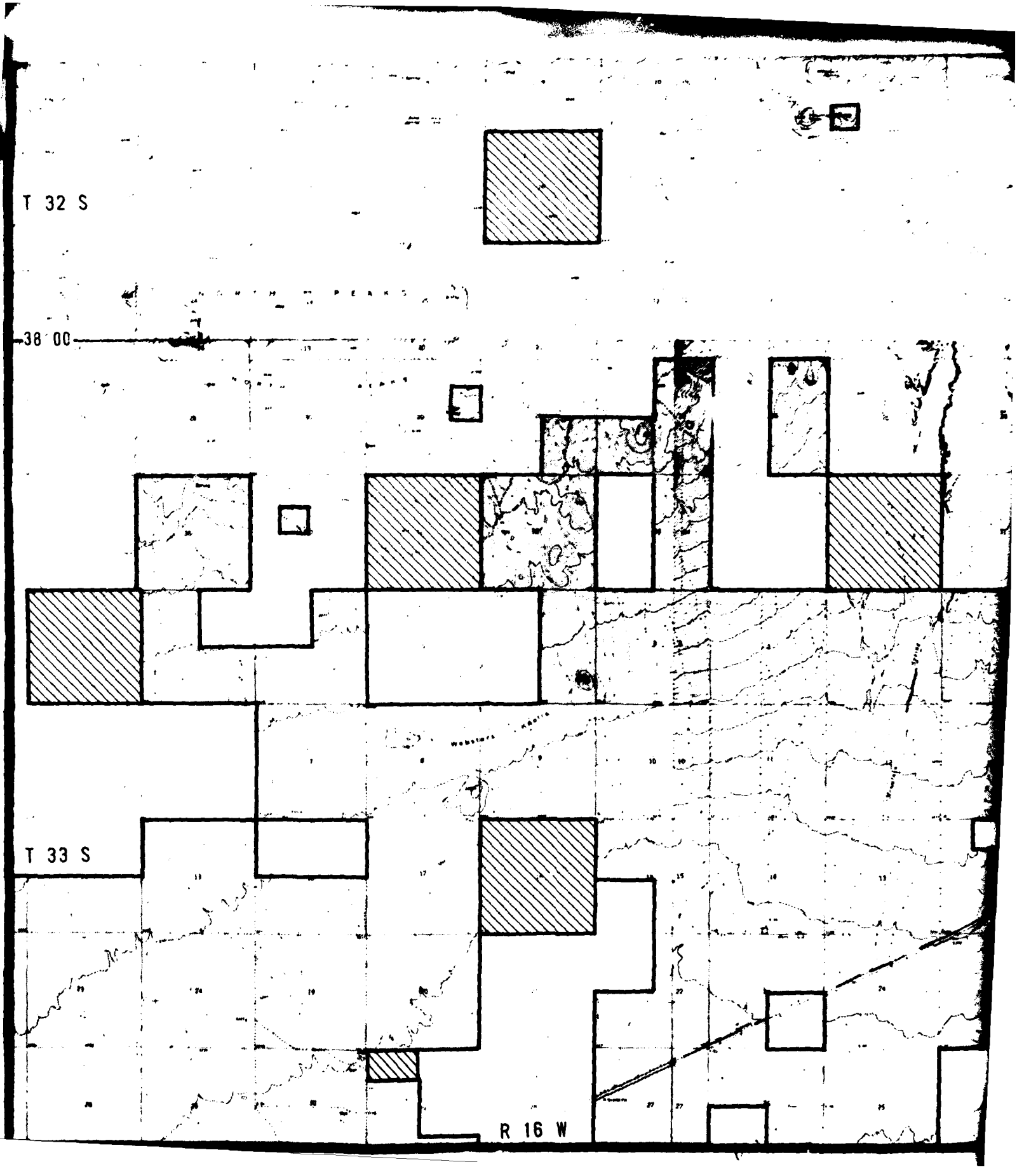

BEAVER CO
IRON CO
OPERATIONAL BASE
OPTION 4

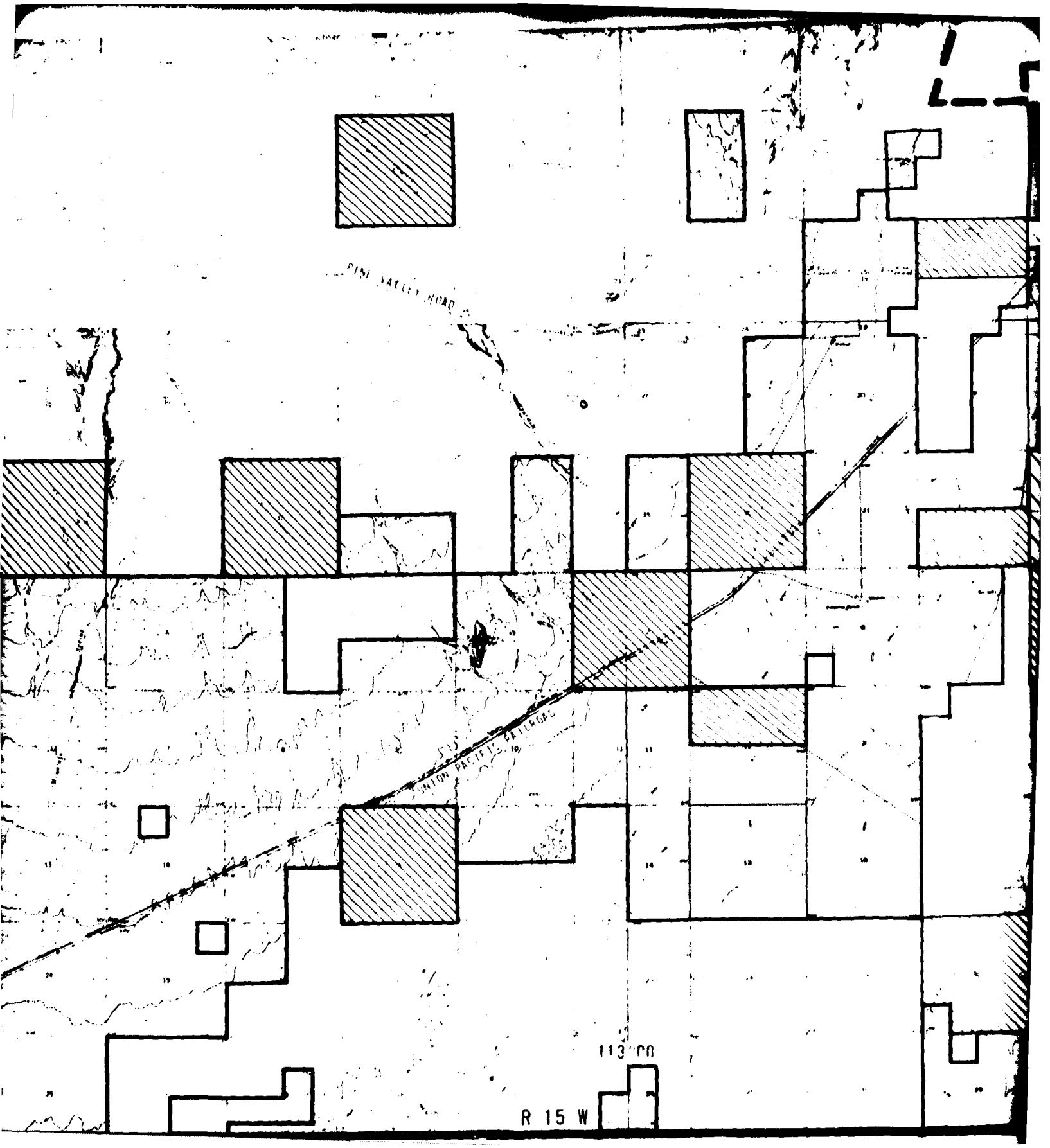

OPERATIONAL BASE
OPTION 3
BEAVER CO
IRON CO
Brown Knoll
E S C A L A N T E
D E S E R T

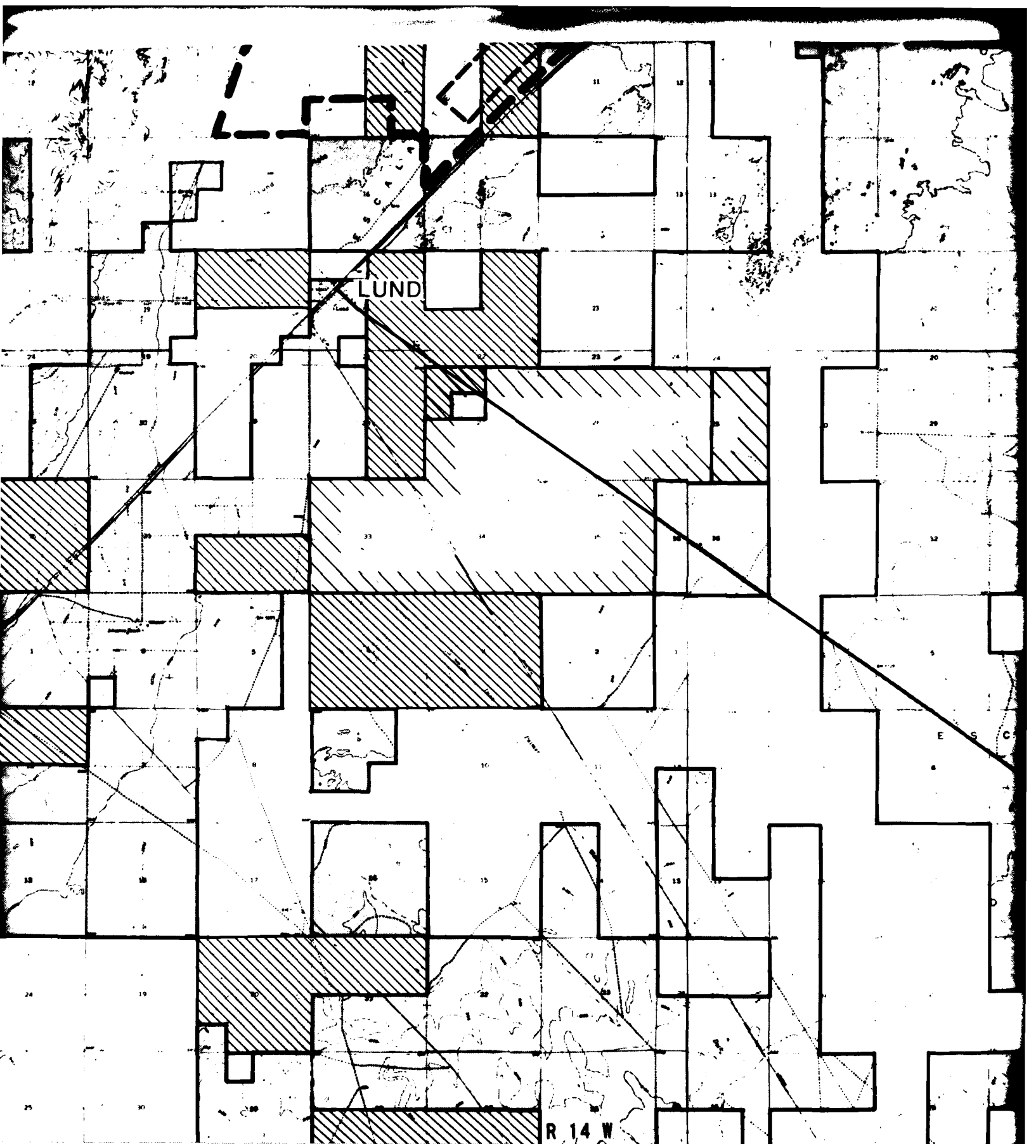

APPROACH/DEPAR
Old Rambler Hwy
Brown Knoll
Canyon
Badger Peak
Hot Springs Canyon Pond
Springs
Canyon
Mound Mtn
B L A C K
M O
First Canyon
Second Canyon
Third Canyon
Horse Valley
Monument
The Narrows
The Neck
Mud
The Stink
Reservoir
BEAVER CO
IRON CO

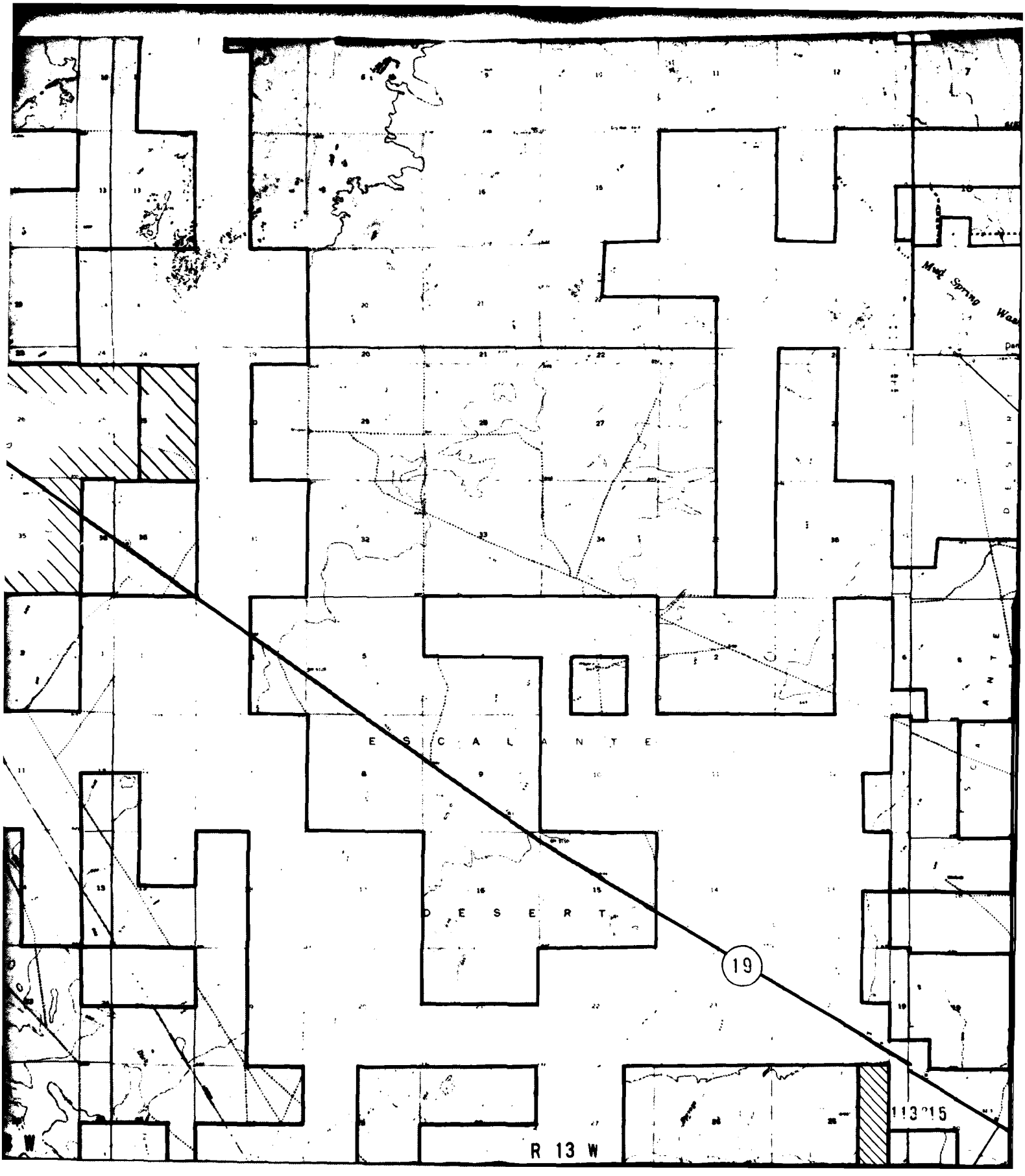

BEAVER CO
IRON CO
Mound Mtn
M O U N T A I N S
Horse Valley
Valley
The Narrows
Marshall Pond
Canyon
130

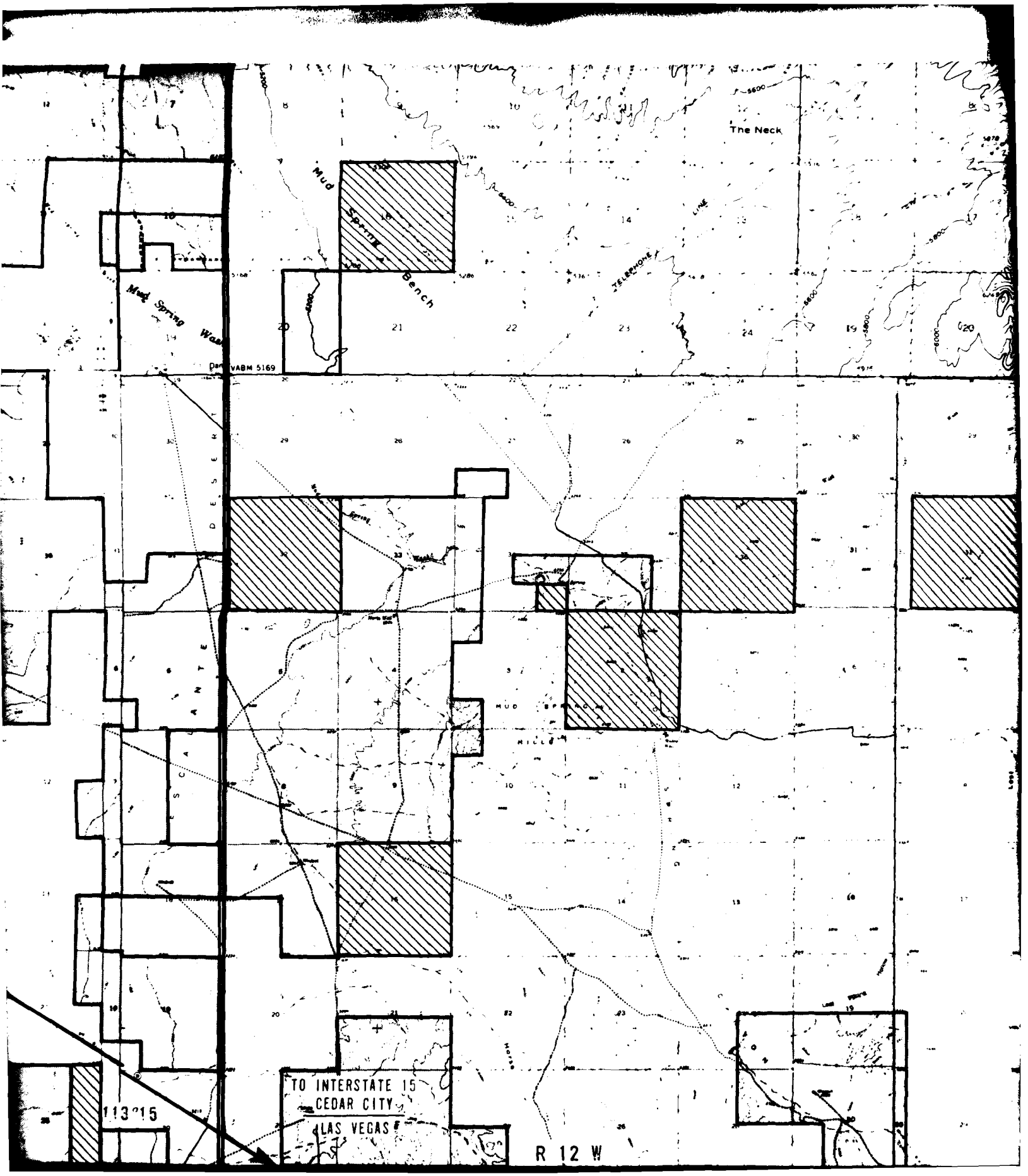

BEAVER CO
IRON CO
Penney Hollow Pond
Burnt Spot Pond
Cutoff Pond
District Pond
T 31 S
R 10 W
130

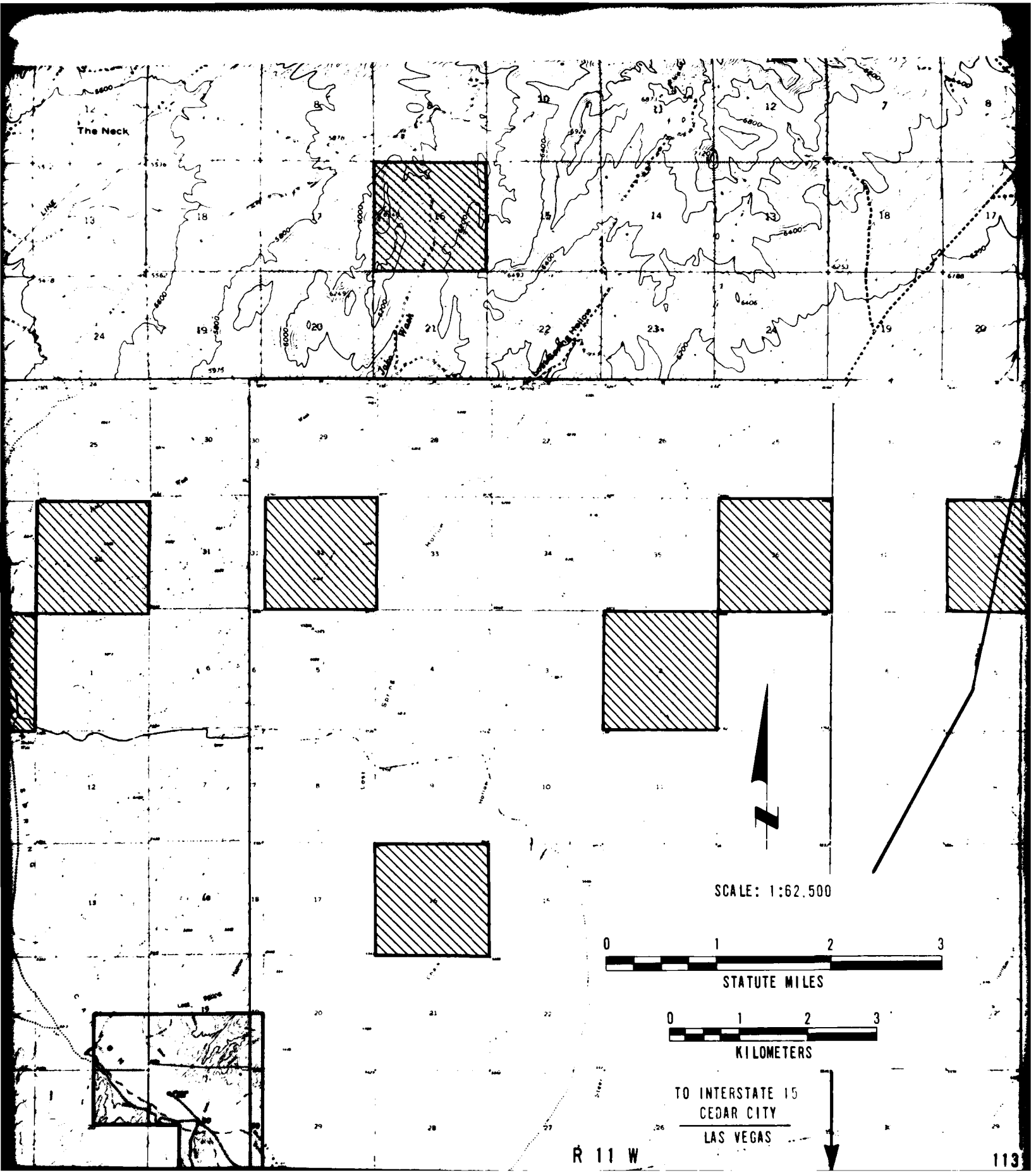

T 32 S
38 00
T 33 S
R 16 W

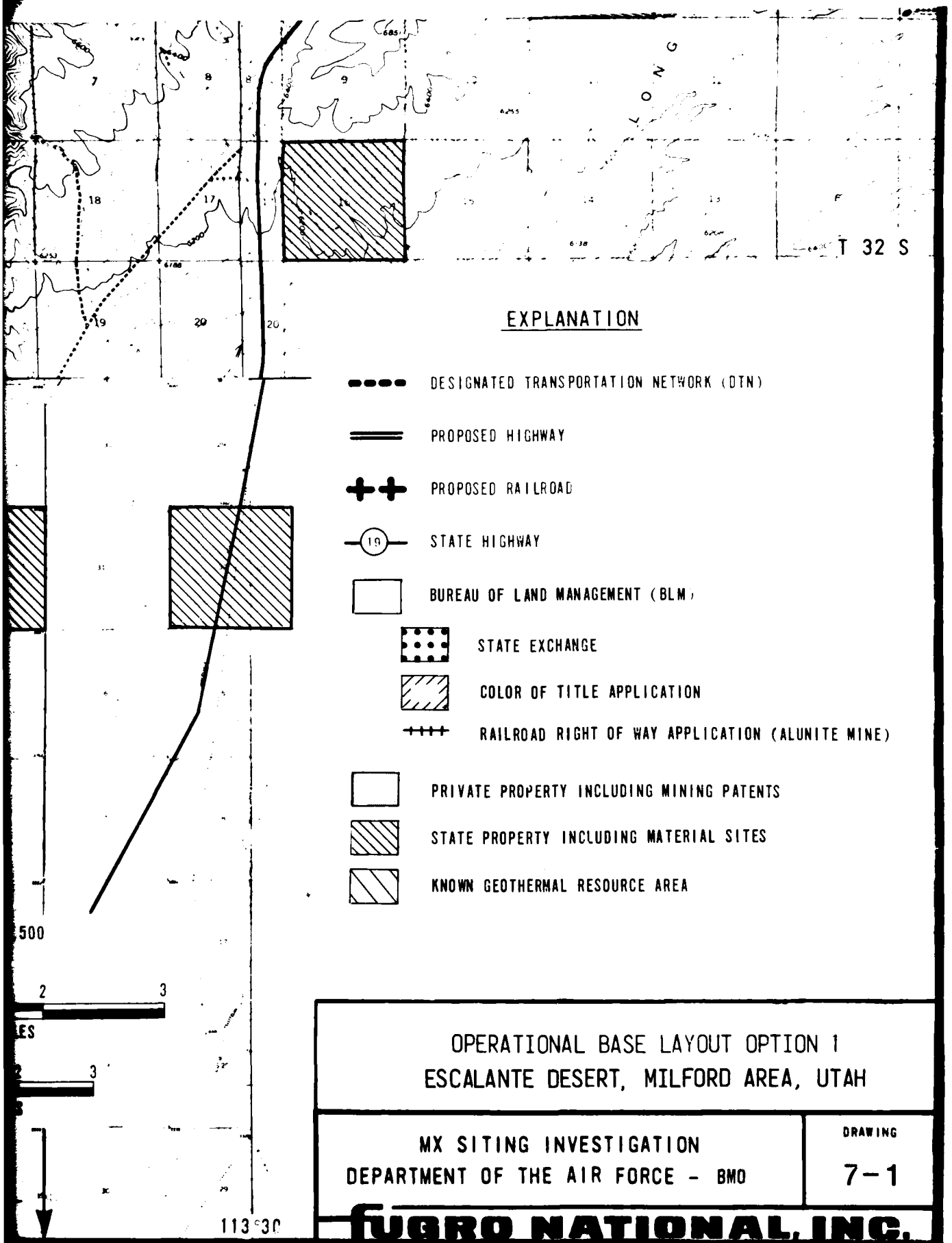

PINE VALLEY ROAD
UNION PACIFIC RAILROAD
113°00
R 15 W


LUND
R 14 W


Mud Spring
E S C A L A N T E
D E S E R T
19
113°15
R 13 W


The Neck
Mud Spring Bench
Mud Spring Wash
TELEPHONE LINE
VABM 5169
DESERT
SANTA
MUD SPRING
MICLO
TO INTERSTATE 15
CEDAR CITY
LAS VEGAS
113°15
R 12 W


The Neck
SCALE: 1:62,500
0 1 2 3
STATUTE MILES
0 1 2 3
KILOMETERS
TO INTERSTATE 15
CEDAR CITY
LAS VEGAS
R 11 W
113



OPERATIONAL BASE LAYOUT OPTION 1
ESCALANTE DESERT, MILFORD AREA, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

DRAWING
7-1

UGRO NATIONAL, INC.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LME